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Botany

NEW SERIES, NO. 40

FLORA COSTARICENSIS

William Burger, Editor

Family #39 Orchidaceae: Tribe Maxillarieae: Subtribes Maxillariinae and Oncidiinae

John T. Atwood

Dora Emilia Mora de Retana

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Families of seed plants known or expected to occur in Costa Rica and adjacent areas, listed alphabetically and numbered according to the sequence of Engler's *Syllabus der Pflanzenfamilien*, edition 11, reworked by L. Diels (1936):

200. Acanthaceae	156. Elaeagnaceae	65. Nyctaginaceae
136. Acoriidaeae	130. Elaeocarpaceae	71. Nymphaeaceae
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77. Annonaceae	96. Fabaceae	39. Orchidaceae
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119. Aquifoliaceae	50. Fagaceae	98. Oxalidaceae
19. Araceae	148. Flacourtiaceae	17. Palmae
165. Araliaceae	82. Fumariaceae	82. Papaveraceae
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61. Balanophoraceae	99. Geraniaceae	5. Pinaceae
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145. Bixaceae	81. Hernandiaceae	111. Polygalaceae
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24. Bromeliaceae	101. Humiriaceae	68. Portulacaceae
91. Brunelliaceae	see Linaceae	9. Potamogetonaceae
38. Burmanniaceae	60a. Hydnoaceae	175. Primulaceae
106. Burseraceae	13. Hydrocharitaceae	55. Proteaceae
12. Butomaceae	188. Hydrophyllaceae	158. Punicaceae
115. Buxaceae	142. Hypericaceae	140. Quinaceae
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96. Caesalpinhiaceae	123. Icacinaceae	73. Ranunculaceae
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114. Callitrichaceae	47. Juglandaceae	128. Rhamnaceae
207. Campanulaceae	27. Juncaceae	160. Rhizophoraceae
36. Cannaceae	97. Krameriaceae	94. Rosaceae
83. Capparidaceae	191. Labiatae	202. Rubiaceae
203. Caprifoliaceae	43. Lacisternaceae	104. Rutaceae
151. Caricaceae	80. Lauraceae	126. Sabiaceae
138. Caryocaraceae	159. Lecythidaceae	44. Salicaceae
70. Caryophyllaceae	96. Leguminosae	125. Sapindaceae
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72. Ceratophyllaceae	28. Liliaceae	193. Scrophulariaceae
63. Chenopodiaceae	101. Linaceae	105. Simarubaceae
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178. Ebenaceae	10. Najadaceae	22. Xyridaceae
		35. Zingiberaceae
		103. Zygophyllaceae

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Dedication

Costa Rica has a proud history of enlightened botanists, both native- and foreign-born. This volume is dedicated to A. R. Endrés, a little-known but productive plant collector and illustrator who died in 1877. Almost nothing is known about him, and he may not have been Costa Rican. What we do know is that he left copious specimens and was one of the most precise illustrators of minute orchids. His last name is Spanish, yet he wrote his notes in English. He was referred to as a "half-caste" (Veitch, J. H. *Hortus Veitchii*, 1906), a label that may indicate parentage of a North American or European and a Latin American. Most of the specimens were ignored during Reichenbach's

life, but some of these were actually new species only recently described by C. A. Luer (*Lindleyana* 10:133–173. 1995). Examination of Endrés' drawings under a dissecting microscope reveals incredibly close shade lines that could be accomplished only by an unusually steady hand. Still more unbelievable was his ability to accurately observe minute details of some of the tiniest orchid flowers. As Reichenbach stated, he was "one of those collectors who cared more for science than for sovereigns" (*Gard. Chron.* 19:432. 1883). The life work of Endrés is preserved at the Reichenbach Herbarium (w) of the Naturhistorisches Museum, Vienna, Austria.

Introduction

This is the first of a series treating the Orchidaceae for *Flora Costaricensis*. It represents the collaborative efforts between authors of very different experience, backgrounds, and cultures, which we believe have complemented one another in the finished product. Usually, such products are made either by a native in the tropics with little access to original materials or by botanists from northern countries with limited access to live material. This product combines the assets of botanists from both perspectives. Germán Carnevali provided the treatment of *Cryptocentrum* using his valuable doctoral dissertation, and Franco Pupulin provided treatments of *Macroclinium* and *Trichocentrum* with D. E. Mora.

This volume features two subtribes, Maxillariinae and Oncidiinae, according to the classification of R. L. Dressler (1981, see references cited within both subtribes). Two hundred twenty-nine species, or about one-fifth of Costa Rican Orchidaceae, are treated. These are among the most conspicuous of Costa Rica's epiphytic orchids, and therefore this treatment should have broad utility among scientists, horticulturists, and the lay public. We are particularly confident in the contribution of two large genera, *Maxillaria* (107 species treated) and *Oncidium* (28 species treated), with many previously confused, misapplied, and superfluous names. This work is based on all available specimens examined from AMES, CR, D, F, INB, MO, and US, supplemented by specimens from herbaria mentioned in the Acknowledgments. Types have been examined as far as is practical, but our access to types has been pri-

marily through microfiche collections of the Ames Herbarium at Harvard University, the Lindley Herbarium at Kew, and the Reichenbach Herbarium in Vienna. In the text, these are indicated as "photo seen." The senior author also has made several trips to the Ames Herbarium in search of types, and one trip to Kew and Vienna. Most of the Maxillariinae have been catalogued on AMO-DATA and will be converted to TROPICOS. Specimens of Oncidiinae continue to be catalogued directly on TROPICOS.

To clarify nomenclature, several specimens are selected as lectotypes or neotypes, and one is selected as an epitype. Neotypes are selected for *Maxillaria acostae* Schltr. (AMES), *M. piestopus* Schltr. (AMES), *M. rousseauae* Schltr. (MO), and *Ornithidium wercklei* Schltr. (AMES). Lectotypes are selected for *M. acervata* Rchb. f. (w), *M. ringens* Rchb. f. (w), *Oncidium fulgens* Schltr. (AMES), *Oncidium globuliferum* Kunth var. *costaricense* Rchb. f. (w), *Oncidium naranjense* Schltr. (AMES), *Oncidium warszewiczii* Rchb. f. (w), *Ornithidium costaricense* Schltr. (AMES), and *Ornithidium tonduzii* Schltr. (US). An epitype is selected for *M. pachyacron* Schltr. (SEL) to serve as a reference specimen for interpreting Schlechter's original description and drawings. These names can be found in the Index.

Many of the individual species descriptions are based on *Icones Plantarum Tropicarum* (series 1), fascicles 14, 15, and 16. Many more specimens have been examined since the appearance of these works, with subsequent modification of the text.

More than 92% of the species in this volume

are illustrated. The illustrations are organized according to their occurrence in the key rather than alphabetically, which we believe will facilitate de-

termination when consulted with the key. The individual species treatments, which are arranged alphabetically, may be consulted as indexes.

Acknowledgments

We thank the herbarium staffs of the Oakes Ames Herbarium of Harvard University (AMES), Museo Nacional (CR), Field Museum of Natural History (F), Instituto de Biodiversidad (INB), Missouri Botanical Garden (MO), Selby Gardens (SEL), National Herbarium (US), and Universidad de Costa Rica (USI) for general support in this project and for providing access to collections. We also thank several other herbaria and their curators for loans, some of which have been borrowed for more than 10 years. These include Duke University (DUKE), Michigan State University (MSC), the University of Michigan (MICH), New York Botanical Garden (NY), and the University of Texas (TEX). Special thanks are extended to the Missouri Botanical Garden, which has supported the botanical efforts of Selby Botanical Gardens from the beginning. We especially thank Peter Raven, the director, as well as members of his staff. Michael Grayum and Barry Hammel supported the project from its initiation in 1988. William Haber provided much logistic support, as well as assistance in field efforts in the Monteverde region, and served as a knowledgeable and enthusiastic field companion. William Burger of the Field Museum has supported the project from the beginning.

There are too many modern collectors to thank for herbarium collections, but we would like to acknowledge some notable historical collectors: A. Alfaro, A. Brenes, A. R. Endrés, O. Jiménez, C. Lankester, P. Standley, and J. Valerio. Alexander Skutch, thankfully still with us, is the last of these illustrious collectors. Much of the Selby herbarium is based on an excellent collection of Costa Rican Orchidaceae assembled by L. O. Williams.

We have many notable botanists to thank for annotating the specimens before us. In particular, we thank Louis O. Williams, Charles Schweinfurth, and Oakes Ames. Bob Dressler reviewed specimens of the Oncidiinae before us.

Dora E. Mora thanks Joaquín García for sharing locality data and vegetative material and for

valuable comments on the manuscript of the Oncidiinae. She also thanks Maria del Carmen Calvo for secretarial assistance.

John T. Atwood thanks W. J. Kress of the National Museum of Natural History (US) for encouragement in the project and D. H. Nicolson for sharing his expertise regarding application of names, for helping us solve a variety of difficult nomenclatural problems, and especially for sharing his philosophy of the use of types.

We thank Calaway H. Dodson for fruitful discussions and for the use of several illustrations from *Icones Plantarum Tropicarum*. Robert L. Dressler freely shared his research on Costa Rican Oncidiinae with us, notably concerning the genera *Notylia* and *Sigmatostalix*. Germán Carnevali provided the treatment of *Cryptocentrum*. Franco Pupulin provided treatments of *Macroclinium* and *Trichocentrum* with D. E. Mora. Lastly, Joaquín García-Castro provided a treatment of *Leucohyle* with D. E. Mora as an Addendum.

Special thanks are extended to curators of two European herbaria. Phillip Cribb and Jeff Wood granted free access to the herbarium at Kew, and Harald Riedl was most helpful by making available the extensive Reichenbach and Kränzlin collections at the Naturhistorisches Museum in Vienna, Austria.

We thank the many artists who worked with us over the several years it took to complete this work, notably Omar Achí, Luís Alfaro, G. Barboza, B. N. Culbertson, Carmen Marín, Stig Dalström, and Willow Zuchowski.

Lastly, we thank our institutions, Marie Selby Botanical Gardens and the University of Costa Rica, for allowing us salaried time to write this volume and to do the necessary field and library research leading to it.

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FLORA COSTARICENSIS
Family #39 Orchidaceae

ORCHIDACEAE

By John T. Atwood and
Dora Emilia Mora de Retana

Subtribe Maxillariinae Benth.

REFERENCES—R. L. Dressler, The Orchids. Harvard University Press, Cambridge, Massachusetts, and London, England, 332 pp. 1981. R. L. Dressler, Phylogeny and Classification of the Orchid Family. Dioscorides Press, Portland, Oregon, 314 pp. 1993. L. O. Williams, An enumeration of the Orchidaceae of Central America, British Honduras and Panama. Ceiba 5:1–256. 1956.

Plant usually epiphytic, or opportunistically terrestrial, caespitose or rhizomatous, sometimes with rhizomes forming upright canes, sympodial or less commonly monopodial, sometimes sympodial as juveniles and monopodial as adults; roots with a white velamen, of varying maximum diameter depending on the species, decurrent on upright stems. Pseudobulb present or absent, when present of a single internode, usually compressed, sometimes grooved, always terminating the shoot. Leaves articulate or rarely secondarily lacking articulations, always conduplicate, rarely equitant, distributed along the rhizome as well as at the pseudobulb apex or restricted to the pseudobulb apex, usually distichous and very rarely spiraled. Inflorescence short or long, lateral on the stem, at the base of the pseudobulb if present, always a single-flowered scape, sometimes formed in clusters (fascicles) within each rhizome bract of what appear to be very condensed, aborted, vegetative

shoots. Flowers exhibiting a great deal of variability, spreading or campanulate, of various colors including green and brown, fragrant or not. Sepals free or variously connate, especially the lateral sepals, sometimes forming a spur. Petals usually similar to the sepals. Lip fixed or hinged to the receptacle or column foot, simple to 3-lobate, variously adorned with calli and hairs. Column usually cylindric, straight or more commonly arcuate, sometimes adorned with wings (Cryptocentrum); pollinia 4, dorso-ventrally superposed in 2 pairs, supported on a well-defined viscidium and usually a stipe. Fruit a capsule.

A Neotropical subtribe of 460–500 species contained in eight genera (recognizing Maxillaria, sensu lato). Four genera with a total of 117 species are found in Costa Rica.

This well-defined subtribe with conduplicate leaves is easily distinguished from closely related Lycastinae Schltr. By the plicate leaves of the latter. One of the most interesting aspects of the Maxillariinae is the variety of growth patterns summarized above, especially those that are sympodial as juveniles, with each abbreviated shoot terminated by a pseudobulb, but monopodial as adults, producing extensive canes lacking pseudobulbs altogether. Perhaps the pseudobulb serves to buffer water stress in small plants, which often live in usually wet but extremely windy habitats. The genus Maxillaria is here accepted in the traditional broad sense, including segregates Camaridium Lindl., Ornithidium R. Br., Pseudomaxillaria Brieger, and Sepalosaccus Schltr. We acknowledge that data from DNA studies currently being generated and analyzed cladistically should help define useful genera within the Maxillariinae.

Key to the Genera of Subtribe Maxillariinae

- 1a. Plants with distinct, cylindric sepaline spur ... Cryptocentrum
1b. Plants not with cylindric sepaline spur, although sepals may be joined ... 2
2a. Flowers with sepals adpressed into a cup at the base with reflexed apices, petals barely or not exerted beyond the reflexed part of the sepal apices giving the flower a trigonous appearance ... Trigonidium
2b. Flowers not as above ... 3
3a. Column lacking a distinct foot, i.e., the base of the column not extended below the ovary;

- scape wiry, the internodes well exposed between scape bracts (Costa Rican), pedicel longer than the ovary *Mormolyca (ringens)*
- 3b. Column with a distinct foot extended below the ovary, scapes with internodes entirely or nearly concealed by bracts, pedicel absent or if present much shorter than ovary *Maxillaria*

Cryptocentrum Benth. & Hook.

(G. Carnevali)

REFERENCES—R. L. Dressler, The systematic position of *Cryptocentrum* (Orchidaceae). *Brittonia* 13:266–270. 1961. G. Carnevali, Systematics, phylogeny, and twig epiphytism in *Cryptocentrum* (Orchidaceae). Ph.D. diss., University of Missouri, St. Louis. 1996.

Herb, epiphytic, rarely subterrestrial or lithophytic, monopodial or less commonly sympodial, if sympodial then stems pseudobulbous-thickened. Roots originating from the lower portions of the stems, frequently decurrent on and totally hiding the stems. **Leaves** distichous or polystichously arranged, conduplicate, coriaceous or succulent, flat or hemicylindric or 3-edged in cross section, articulate, glabrous, margins ciliate or erose; leaf sheaths usually wider than the blades, imbricate, conspicuously nerved. **Inflorescences** 1-flowered, usually originating from the axils of the lowermost leaf sheaths; ovary with pedicel 6-edged, subterete, smooth, rarely winged. **Flowers** resupinate, nocturnally fragrant, greenish or yellowish, often with purplish suffusion. **Sepals** basally connate into a tube, free and somewhat divergent above; tube obconic, often fleshy-thickened; lateral sepals often longer than dorsal, basally produced into a backwardly oriented sepaline spur; sepaline spur cylindric, apically acute or somewhat saccate. **Petals** free,

basally enclosed by the sepaline tube, the free portion usually lanceolate or oblong, erect, spreading to somewhat reflexed and then called the bent portion; bent portion frequently somewhat tailed, commonly triangular or triangular-lanceolate, fleshier than the basal portion. **Lip** basally produced into a backwardly oriented spur contained within the sepaline spur, the walls of the labellar spur fused with the roof of the sepaline spur; the lip blade without callus, elliptic or ovate when flattened, divided into a deeply concave or saccate hypochile contained in the sepaline tube and an erect, spreading, or reflexed, somewhat concave epichile. **Column** erect, stout, with 2 wings abaxially; anther terminal, pollinia 4 in 2 superposed pairs, waxy, supported on a stipe and viscidium. **Fruit** a capsule, oblongoid or ellipsoid, beakless.

A Neotropical genus of 17 species ranging from the Cordillera de Tilarán in northern Costa Rica to the Amazonian slopes of the Andes in Bolivia with two disjunct species in the Guayana region.

A genus well-defined by several apomorphies, *Cryptocentrum* is closely related to *Anthosiphon* (G. Carnevali, unpubl. diss.) and appears to have evolved from that genus by elongation of the sepaline spur and proportional reduction of the sepaline cup.

Key to the Species of *Cryptocentrum*

- 1a. Leaves spiraled (polystichous) on the stem, subterete, < 3 cm long; inflorescence longer than to subequaling the subtending leaves; floral bract conspicuously shorter than the spur, only enclosing the apical 1/3 or less of it 2
- 2a. Spur 12–14.5 mm long, inflorescence subequaling or little longer than subtending leaves; monopodia shorter than leaves on mature plants; leaves (30)40–60(70) mm long, 0.5–1.5 mm thick when fresh; leaf sheaths not or inconspicuously attenuated apically, not becoming clawed; lateral sepals always 3-nerved *C. flavum*
- 2b. Spur (15)16–19 mm long; inflorescence always conspicuously longer than subtending leaves; monopodia longer than leaves on mature plants; leaves (10)15–25(30) mm long, 0.3–0.5 mm thick when fresh; leaf sheath apically conspicuously attenuated and becoming clawed; lateral sepals usually 5-nerved, only rarely 3-nerved *C. standleyi*
- 1b. Leaves distichous on the stem, subterete or flat, usually ≥ 4 cm long; inflorescence shorter or rarely subequaling the subtending leaves; floral bract longer than the spur, enclosing at least 3/4 of its length 3
- 3a. Leaves terete or hemiterete, 1–2(3) mm wide and thick *C. gracillimum*
- 3b. Leaves flat, 4–10(20) mm wide 4

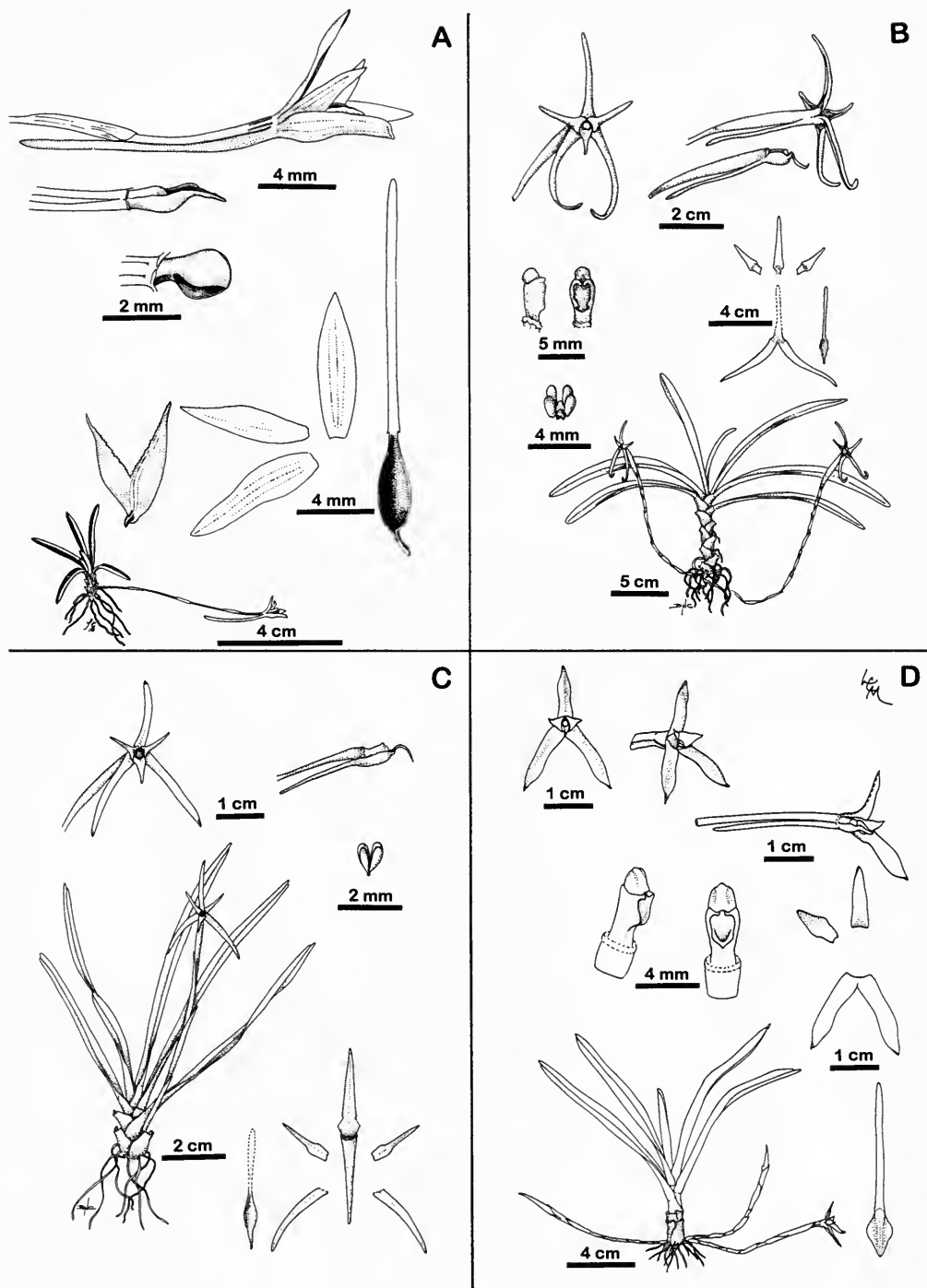


FIG. 1. A, *Cryptocentrum standleyi* (Icon. Pl. Trop. 14: t. 1309. Illustrator: S. Dalström). B, *C. latifolium* (Icon. Pl. Trop. 14: t. 1308. Illustrator: B. N. Culbertson). C, *C. calcaratum* (Icon. Pl. Trop. 14: t. 1307. Illustrator: B. N. Culbertson). D, *C. lehmannii* (Icon. Pl. Trop. 1: t. 33. Illustrator: B. N. Culbertson).

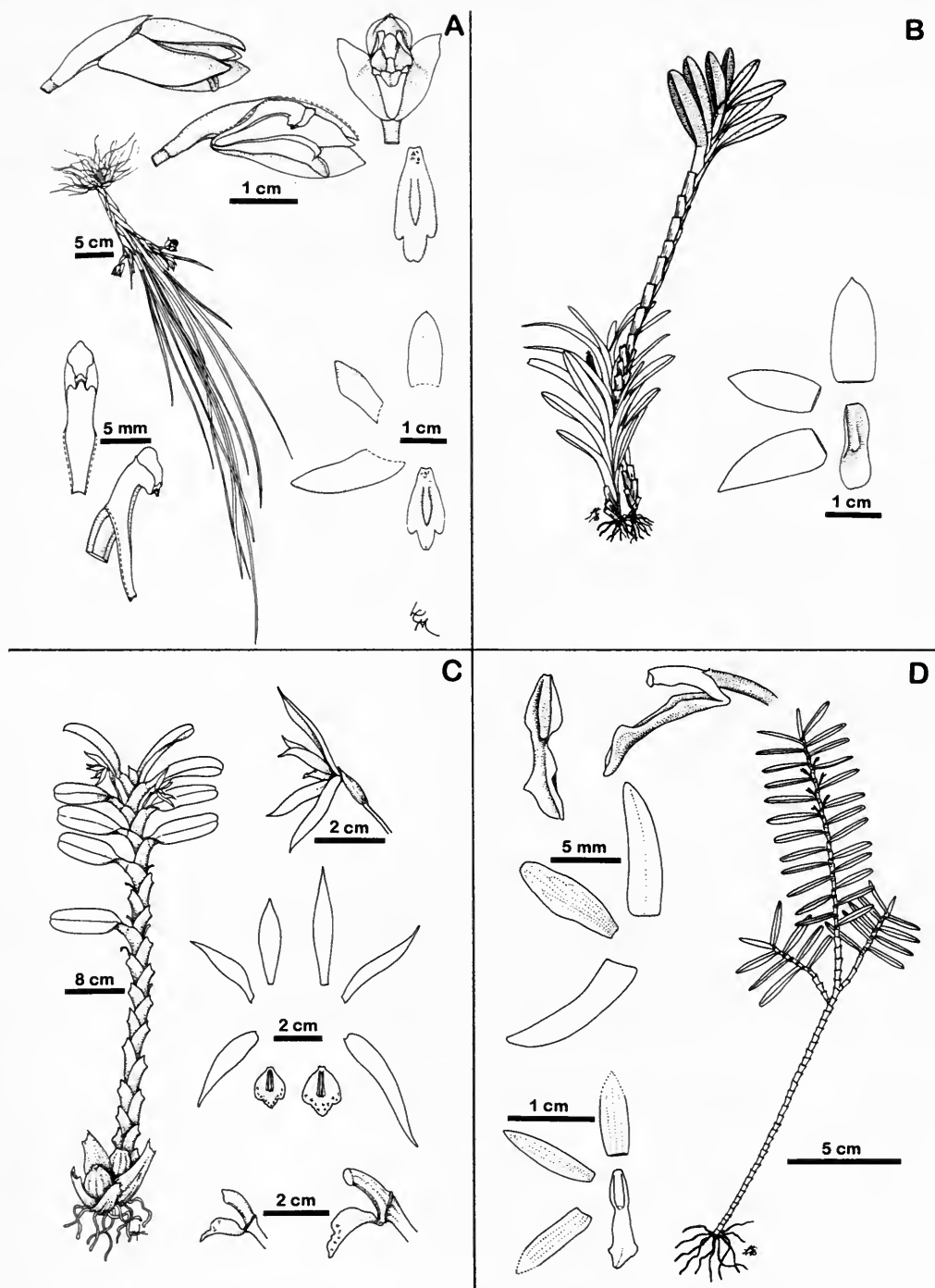


FIG. 2. A, *Maxillaria lueri* (Icon. Pl. Trop. 2: t. 155. Illustrator: L. Megahee). B, *M. alfaroi* (illustrator: S. Dalström). C, *M. inaudita* (Icon. Pl. Trop. 14: t. 1349. Illustrator: B. N. Culbertson). D, *M. valerioi* (illustrator: S. Dalström).

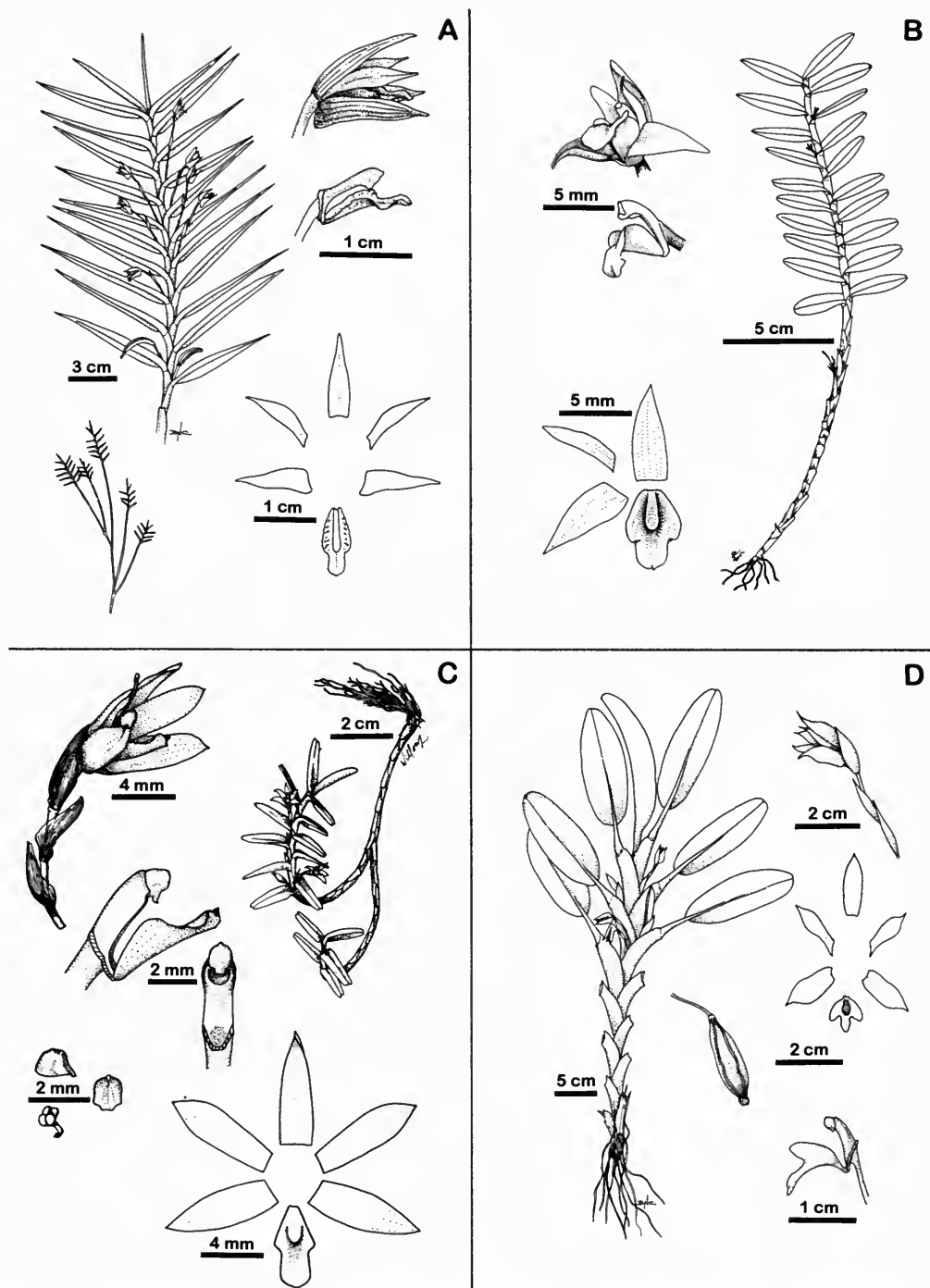


FIG. 3. A, *Maxillaria linearifolia* (Icon. Pl. Trop. 14: t. 1350. Illustrator: B. N. Culbertson). B, *M. appendiculoides* (illustrator: S. Dalström). C, *M. dendrobioides* (illustrator: W. Zuchowsky). D, *M. trilobata* (Icon. Pl. Trop. 14: t. 1367. Illustrator: B. N. Culbertson).

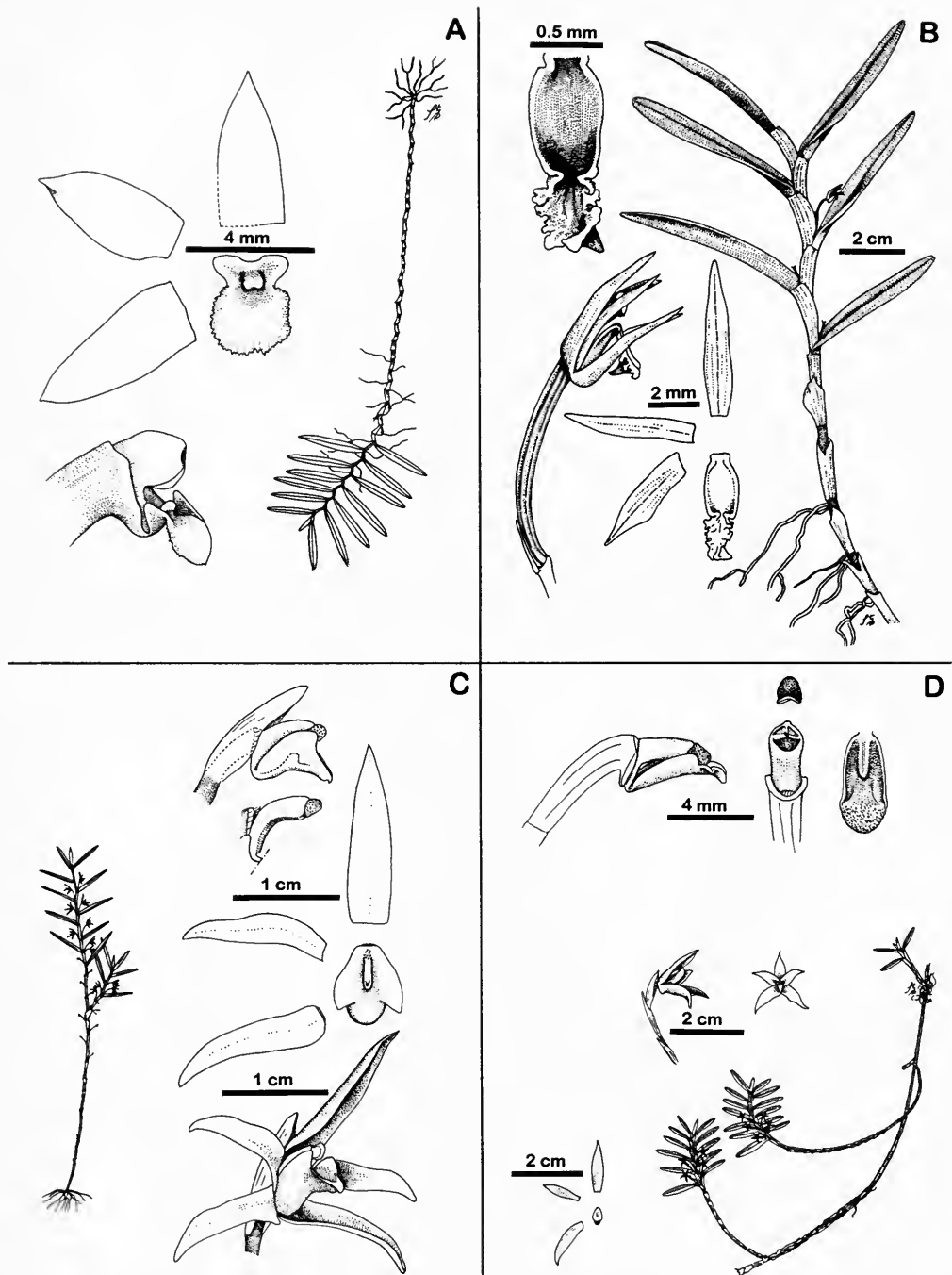


FIG. 4. A, *Maxillaria adendrobium* (illustrator: S. Dalström). B, *M. nicaraguensis* (Icon. Pl. Trop. 14: t. 1355. Illustrator: S. Dalström). C, *M. tonduzii* (illustrator: S. Dalström). D, *M. parvilabia* (illustrator: S. Dalström).

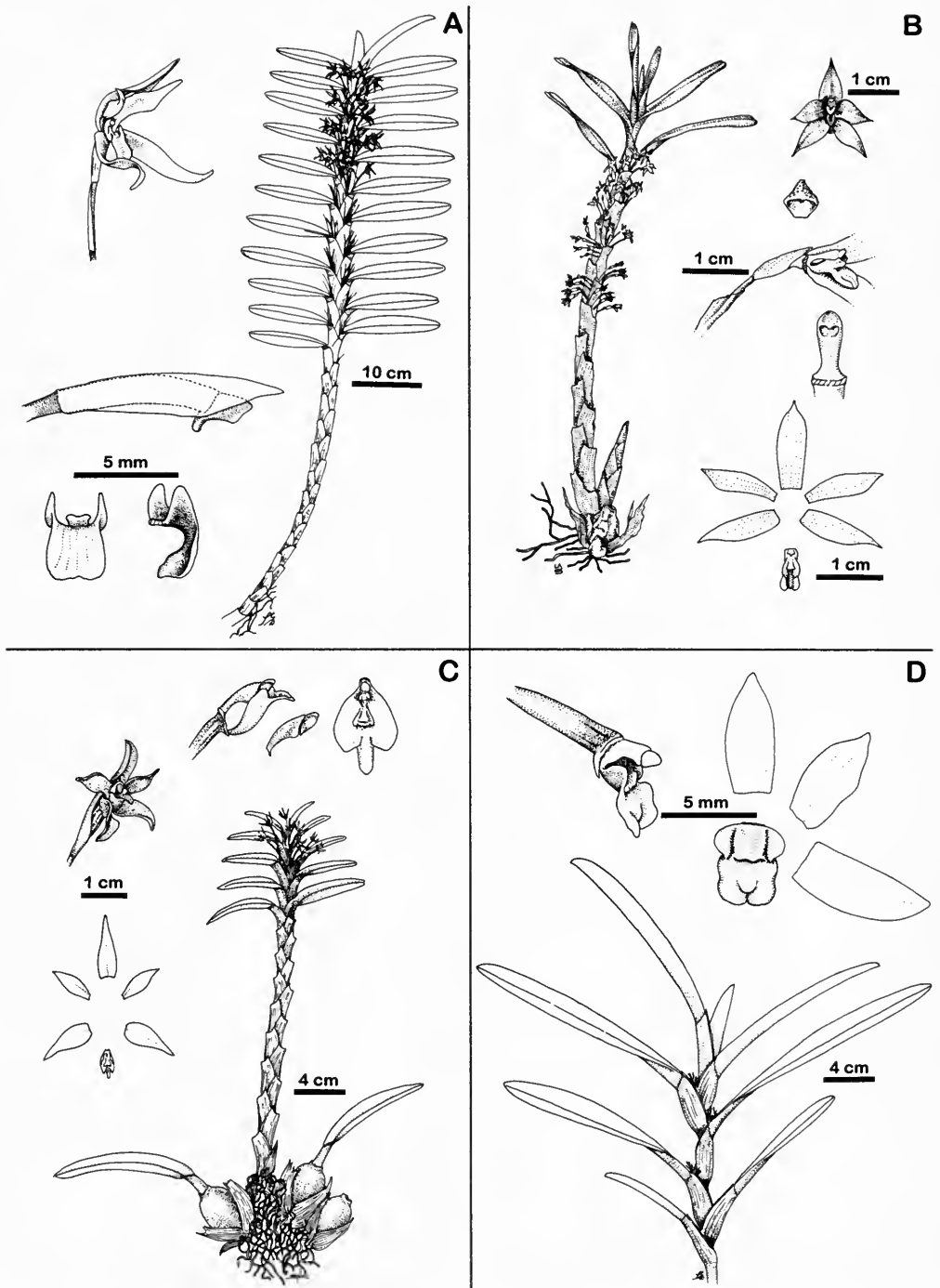


FIG. 5. A, *Maxillaria biolleyi* (illustrator: S. Dalström). B, *M. quadrata* (illustrator: L. Alfaro). C, *M. adolphii* (illustrator: B. N. Culbertson). D, *M. conduplicata* (illustrator: S. Dalström).

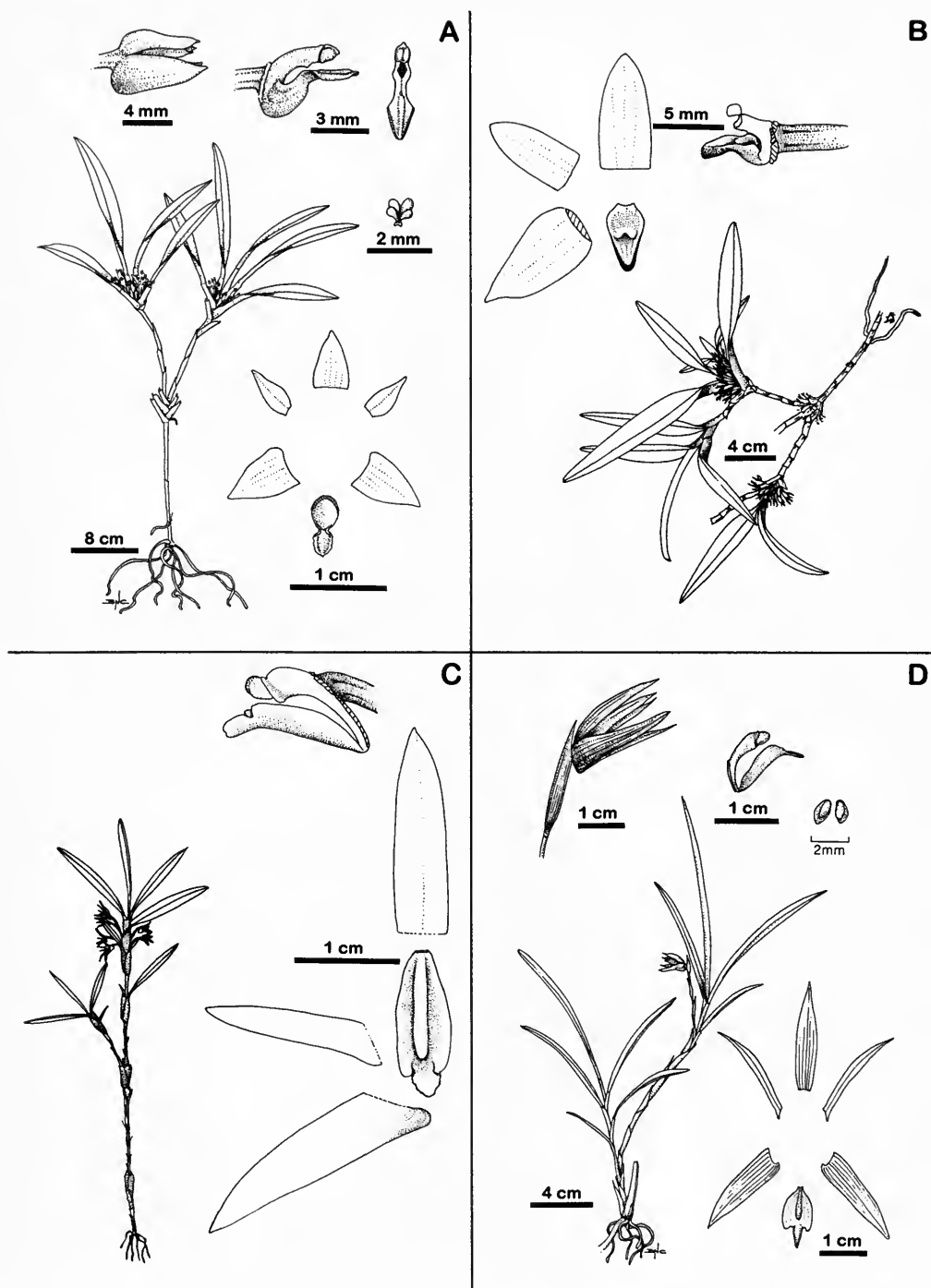


FIG. 6. A, *Maxillaria fulgens* (Icon. Pl. Trop. 14: t. 1348. Illustrator: B. N. Culbertson). B, *M. pittieri* (illustrator: S. Dalström). C, *M. exaltata* (illustrator: S. Dalström). D, *M. meridensis* (Icon. Pl. Trop. 14: t. 1352. Illustrator: B. N. Culbertson).

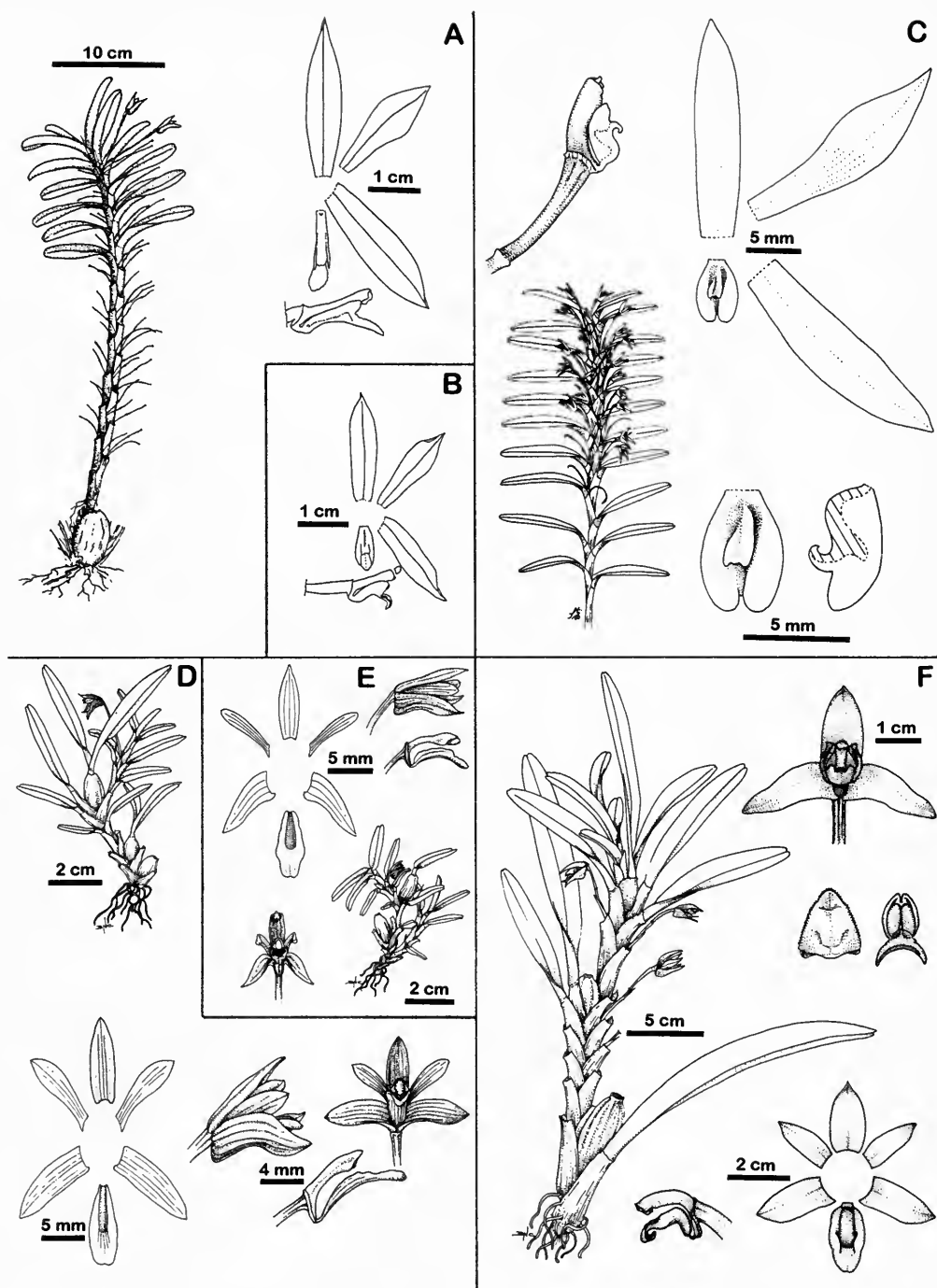


FIG. 7. **A**, *Maxillaria monteverdensis* (Lindleyana 9:241. Illustrator: G. Barboza). **B**, *M. amabilis* (Lindleyana 9:241. Illustrator: J. T. Atwood). Note: Plant habit is similar to that in Figure 7A. **C**, *M. falcata* (illustrator: S. Dalström). **D**, *M. acervata* (Icon. Pl. Trop. 14: t. 1346 [as synonym, *M. foliosa*]. Illustrator: B. N. Culbertson). **E**, *M. ponerantha* (Icon. Pl. Trop. 14: t. 1358. Illustrator: B. N. Culbertson). **F**, *M. elatior* (illustrators: plant habit, B. N. Culbertson; floral diagnosis, L. Alfaro).

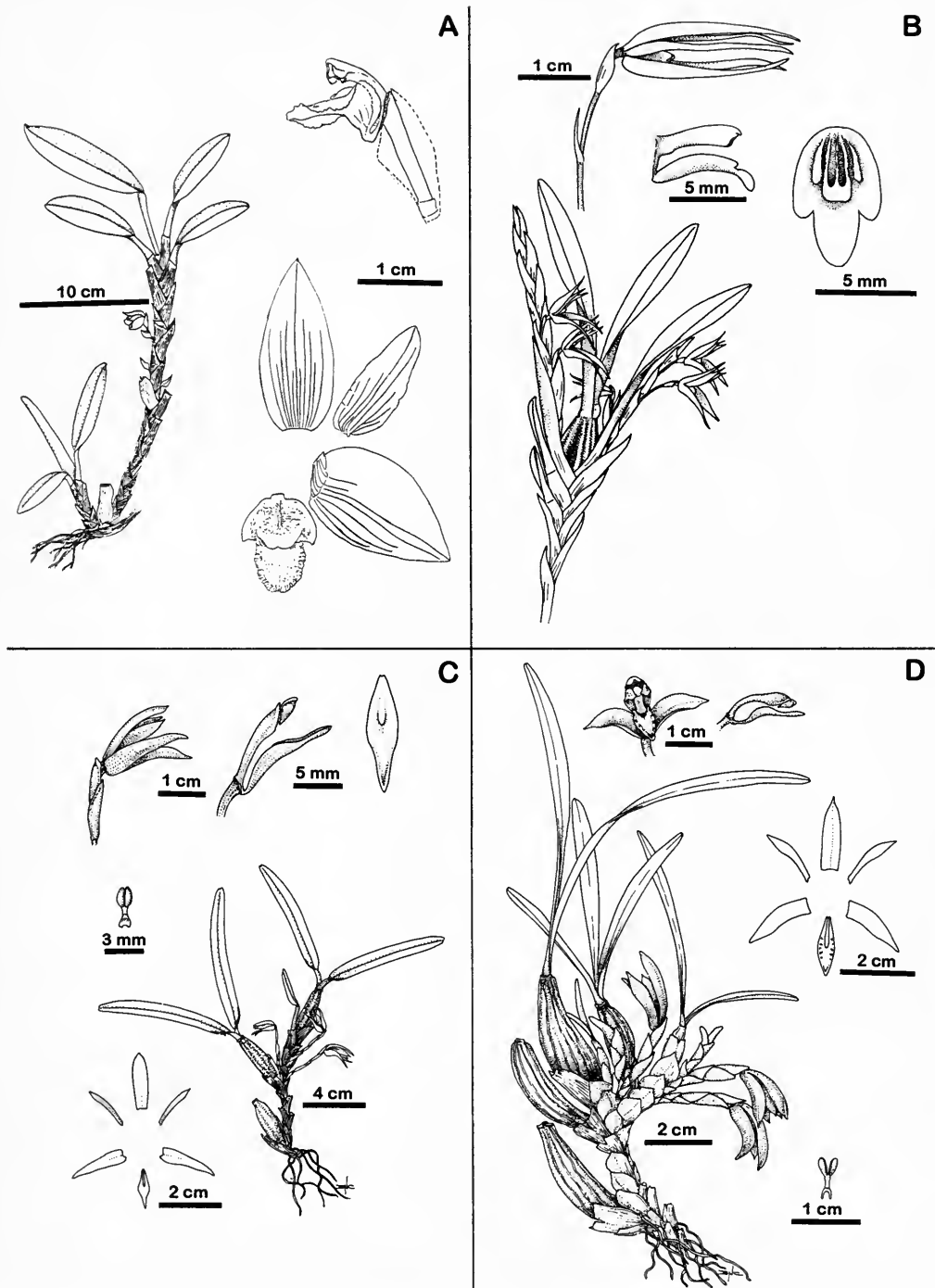


FIG. 8. A, *Maxillaria tubercularis* (Lindleyana 9:229. Illustrator: G. Barboza). B, *M. ctenostachya* (illustrator: S. Dalström). C, *M. friedrichsthalii* (Icon. Pl. Trop. 14: t. 1347. Illustrator: B. N. Culbertson). D, *M. scorpioidea* (Icon. Pl. Trop. 14: t. 1363. Illustrator: B. N. Culbertson).

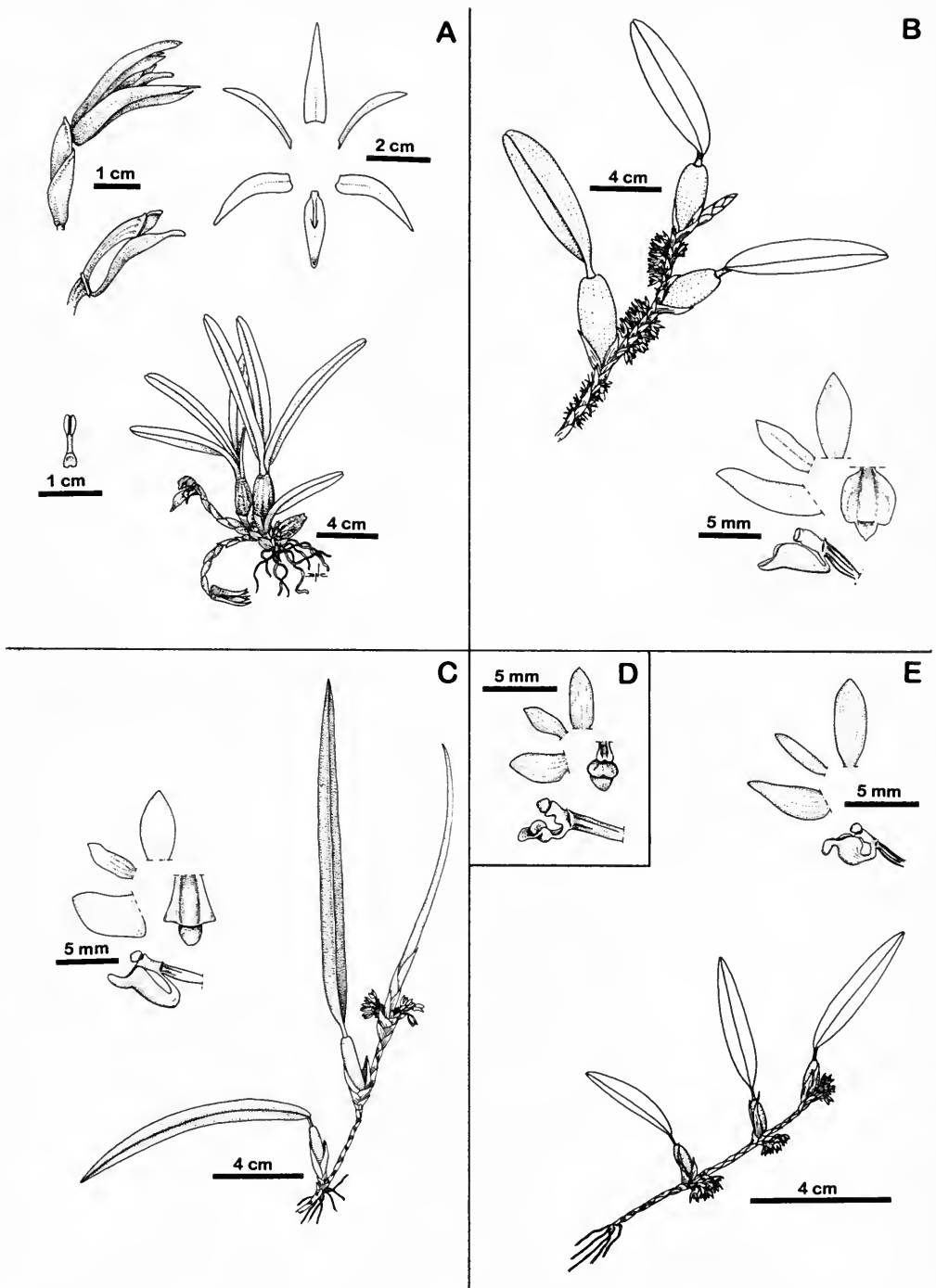


FIG. 9. **A**, *Maxillaria aciantha* (Icon. Pl. Trop. 14: t. 1333. Illustrator: B. N. Culbertson). **B**, *M. brevilabia* (illustrator: S. Dalström). **C**, *M. neglecta* (illustrators: plant habit, S. Dalström; floral diagnosis, Lindleyana 8:27, S. Dalström). **D**, *M. parviflora* (Lindleyana 8:27. Illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 9E. **E**, *M. concavilabia* (illustrators: plant habit, S. Dalström; floral diagnosis, Lindleyana 8:27, S. Dalström).

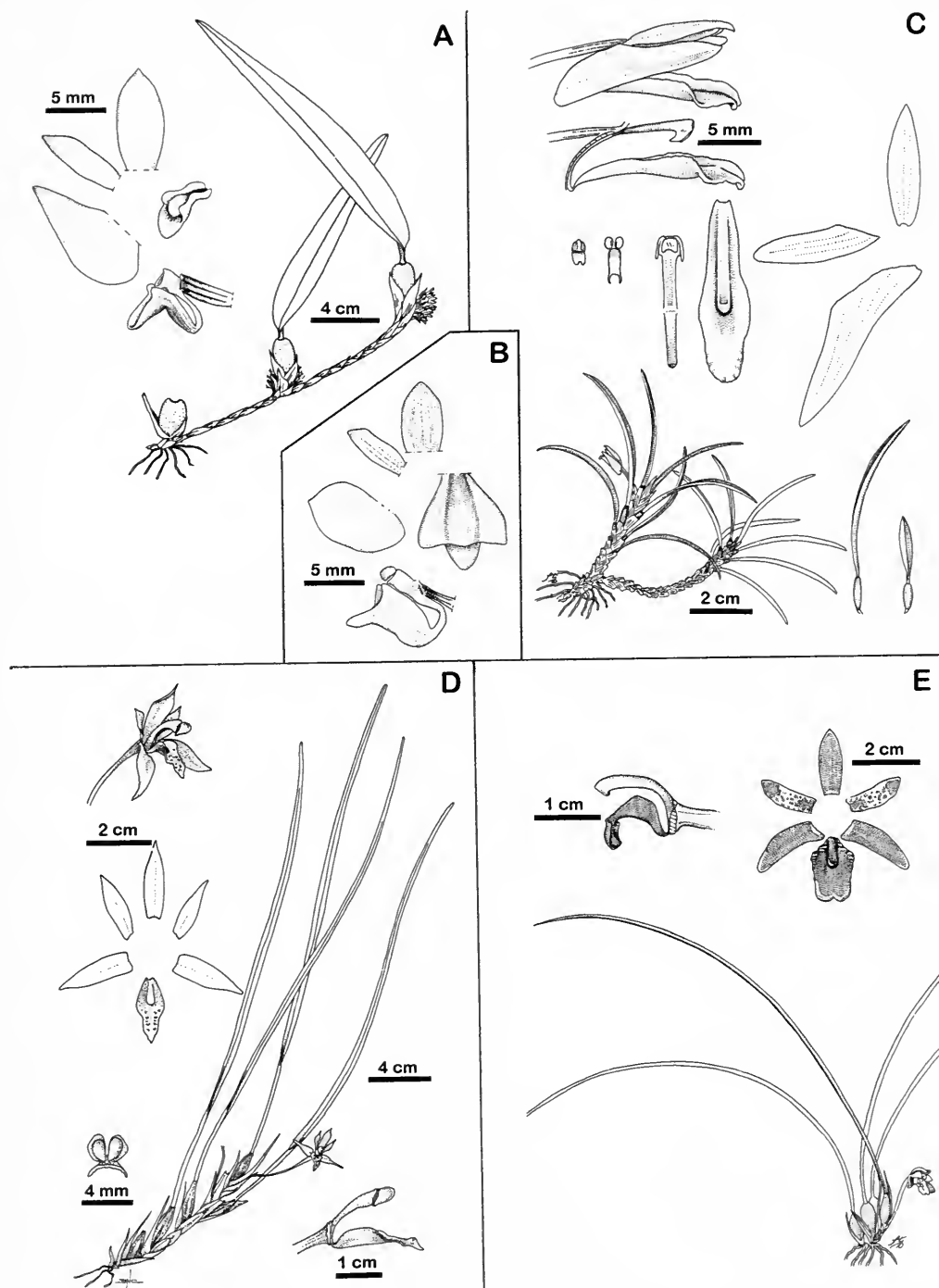


FIG. 10. **A**, *Maxillaria horichii* (illustrators: plant habit, S. Dalström; floral diagnosis, Lindleyana 8:27, S. Dalström). **B**, *M. pseudoneglecta* (Lindleyana 8:27. Illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 10A. **C**, *M. uncata* (Icon. Pl. Trop. 14: t. 1369. Illustrator: S. Dalström). **D**, *M. tenuifolia* (Icon. Pl. Trop. 14: t. 1366. Illustrator: B. N. Culbertson). Note: Lip from rehydrated flower, somewhat straightened. **E**, *M. sanguinea* (illustrators: plant habit, Icon. Pl. Trop. 14: t. 1362, S. Dalström; floral diagnosis, Icon. Pl. Trop. 15: t. 1362a, L. Alfaro).

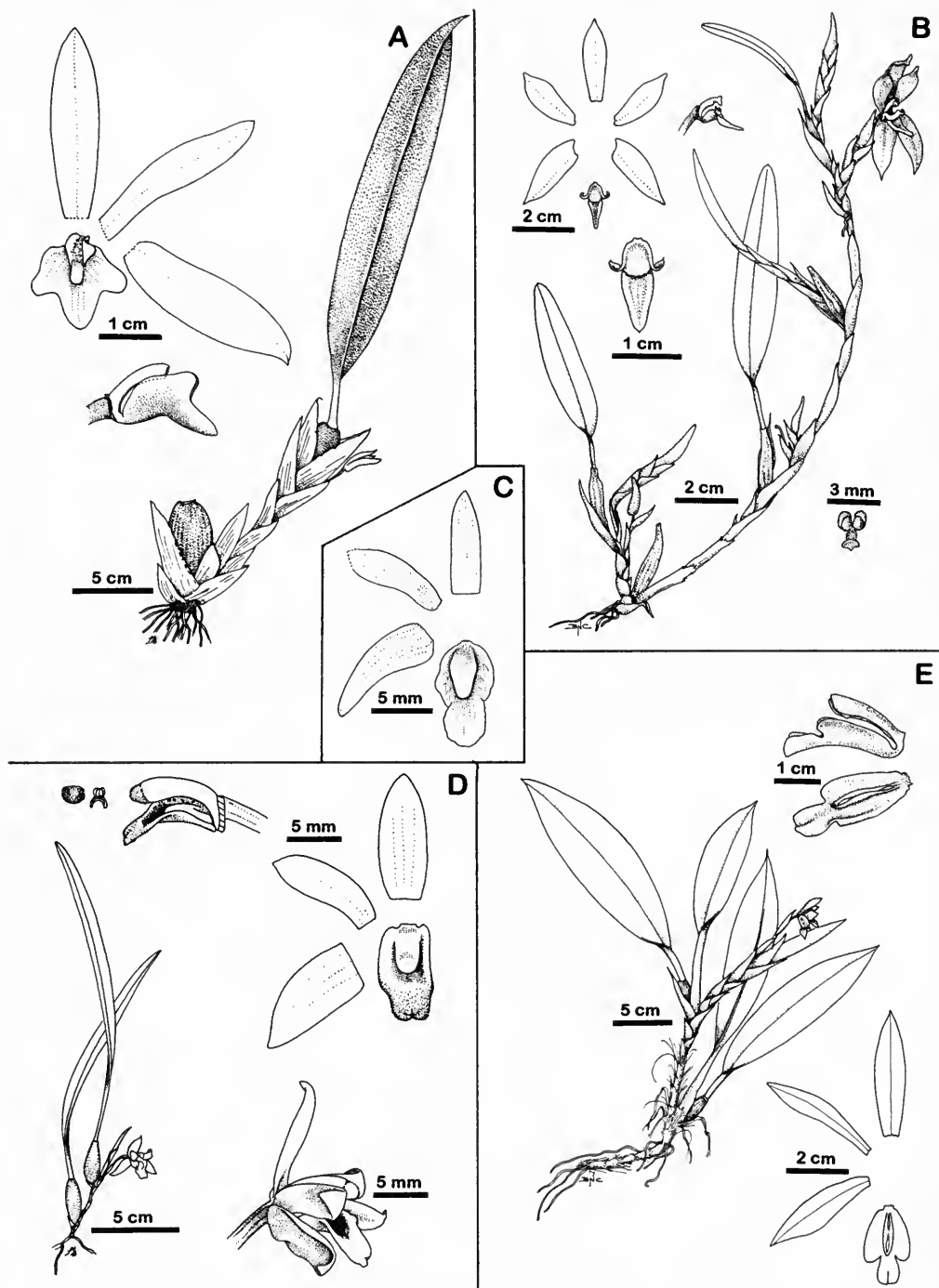


FIG. 11. A, *Maxillaria planicola* (illustrator: S. Dalström). B, *M. tigrina* (Icon. Pl. Trop. 14: t. 1306 [as synonym, *Chrysocynis tigrinum*]). Illustrator: B. N. Culbertson). C, *M. variabilis* (illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 11D. D, *M. costaricensis* (illustrator: S. Dalström). E, *M. haberi* (Selbyana 16:244. Illustrator: B. N. Culbertson).

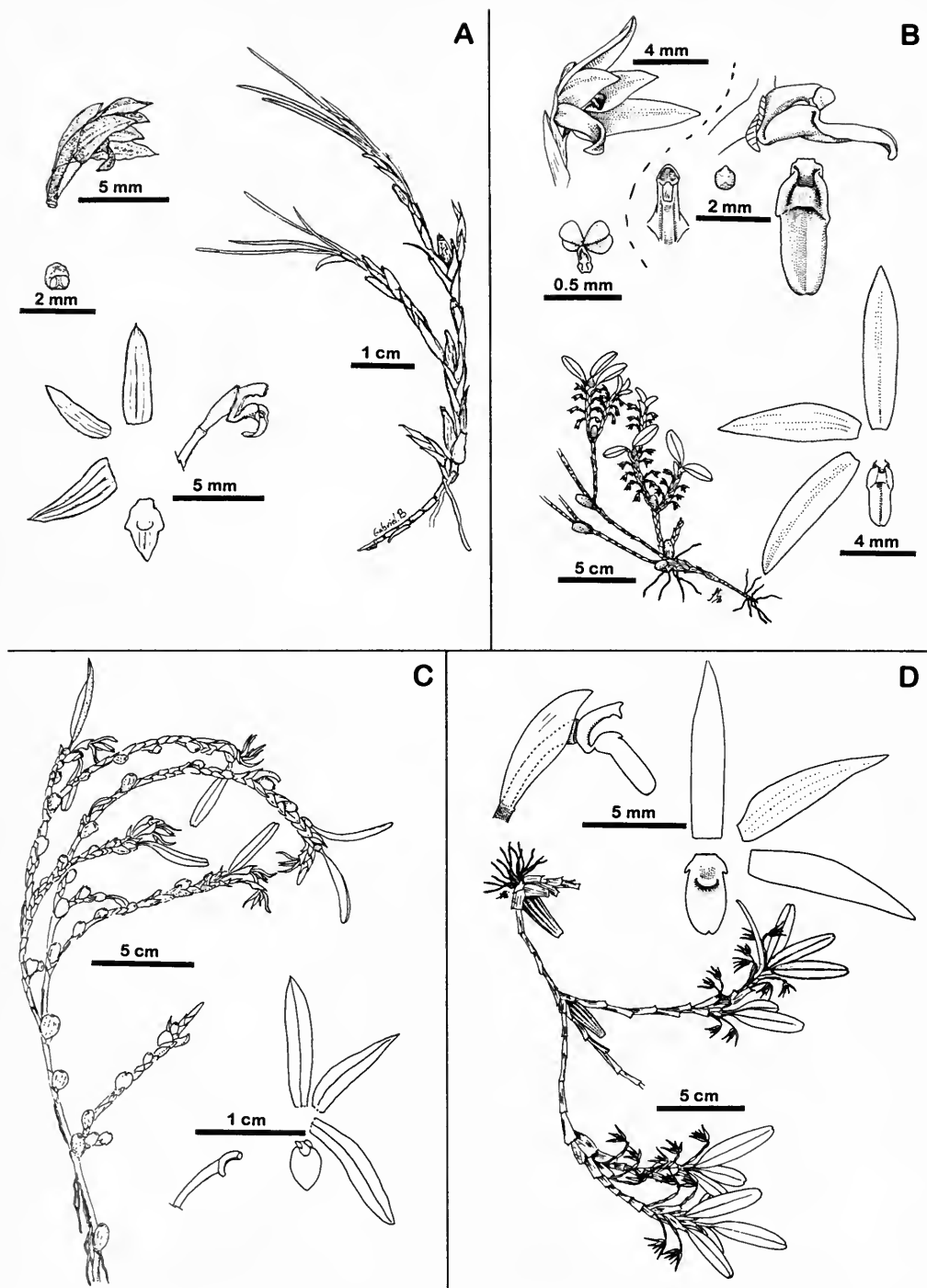


FIG. 12. A, *Maxillaria muscoides* (Lindleyana 9:235. Illustrator: G. Barboza). B, *M. microphyton* (illustrator: S. Dalström). C, *M. burgeri* (Lindleyana 9:234. Illustrator: G. Barboza). D, *M. flava* (illustrator: S. Dalström).

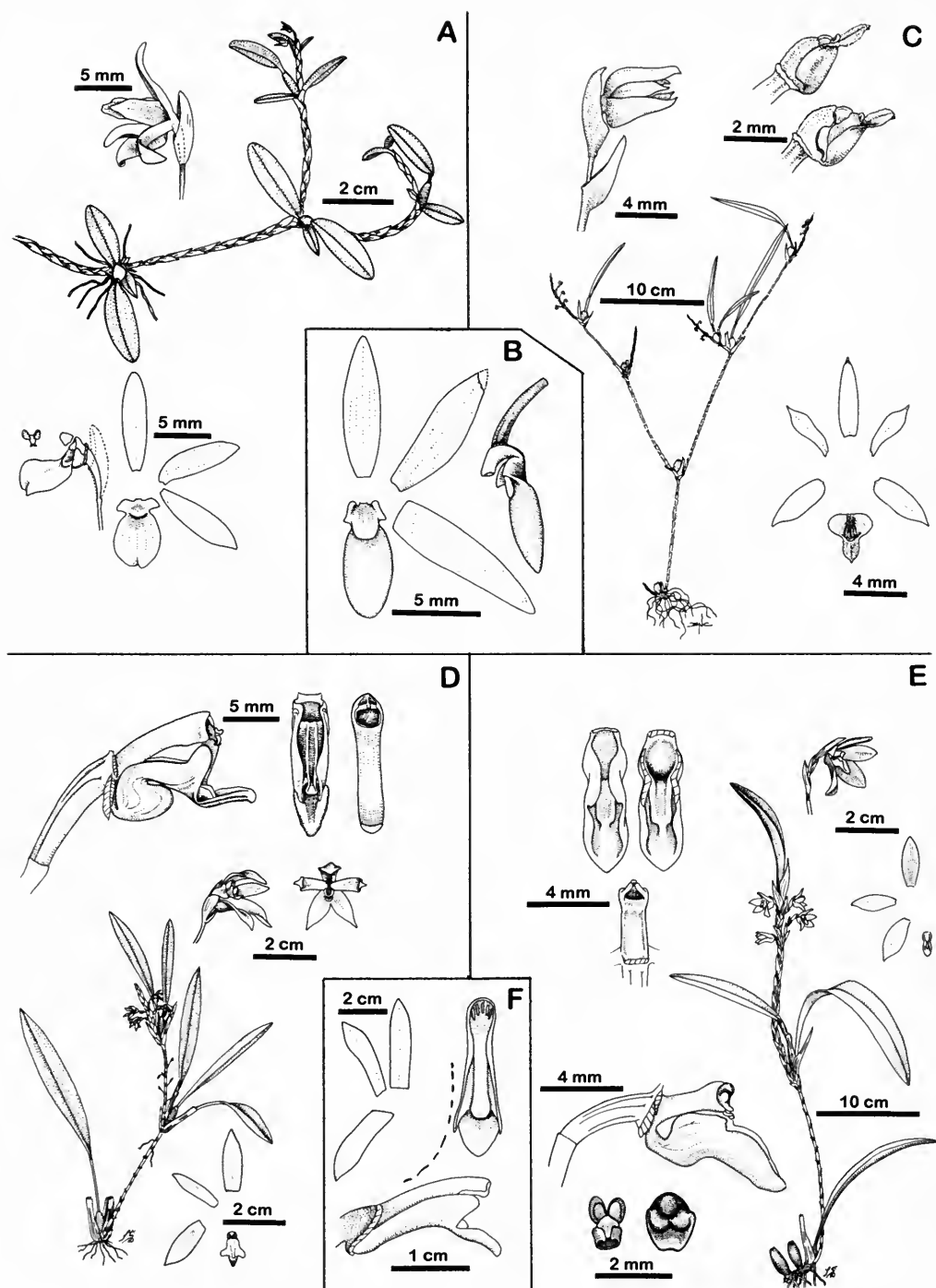


FIG. 13. A, *Maxillaria wercklei* (illustrator: S. Dalström). B, *M. lankesteri* (illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 13A. C, *M. minor* (Icon. Pl. Trop. t. 14: 1353. Illustrator: B. N. Culbertson). D, *M. sigmoidea* (illustrator: S. Dalström). E, *M. paleata* (illustrator: S. Dalström). F, *M. vaginalis* (illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 13D.

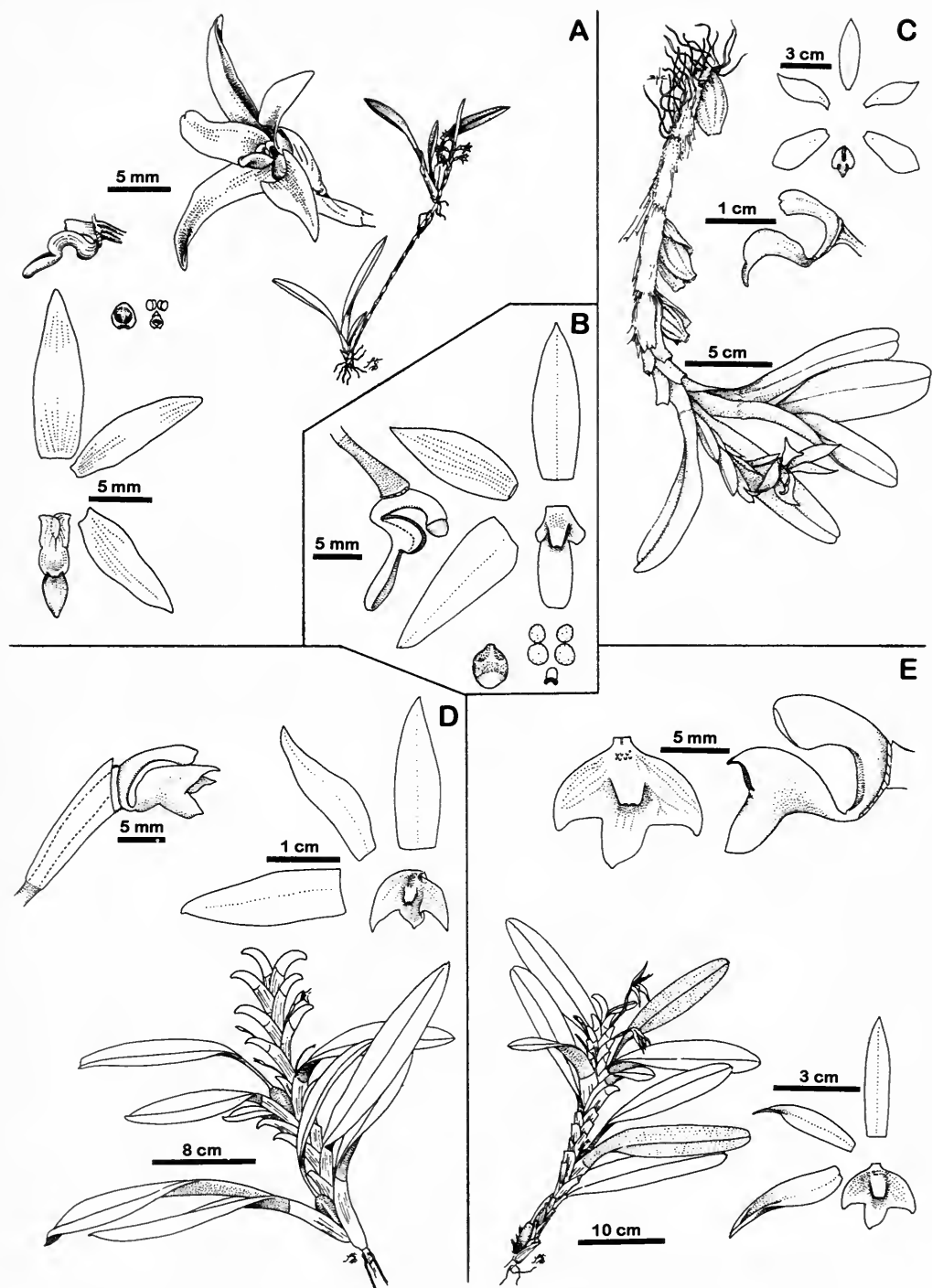


FIG. 14. A, *Maxillaria schlechteriana* (Lindleyana 9:230. Illustrator: S. Dalström). B, *M. dichotoma* (illustrator: S. Dalström). Note: Plant habit is similar to that in Figure 14A. C, *M. suaveolens* (Icon. Pl. Trop. 14: t. 1365. Illustrator: B. N. Culbertson). D, *M. bradeorum* (illustrator: S. Dalström). E, *M. ampliflora* (illustrator: S. Dalström).

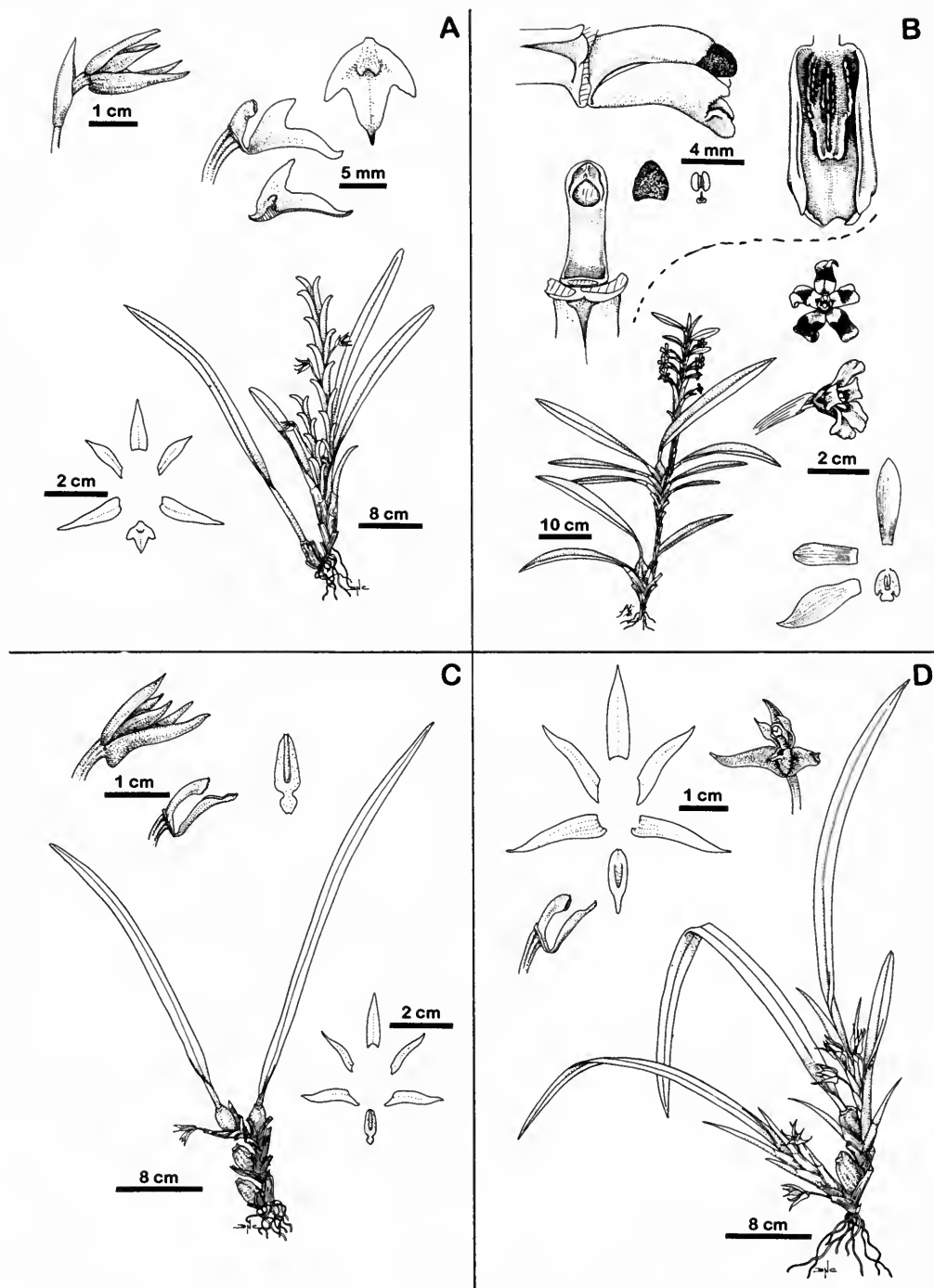


FIG. 15. A, *Maxillaria umbratilis* (Icon. Pl. Trop. 14: t. 1368. Illustrator: B. N. Culbertson). B, *M. campanulata* (illustrator: S. Dalström). C, *M. oreocharis* (Icon. Pl. Trop. 14: t. 1356. Illustrator: B. N. Culbertson). D, *M. alba* (Icon. Pl. Trop. 14: t. 1334. Illustrator: B. N. Culbertson).

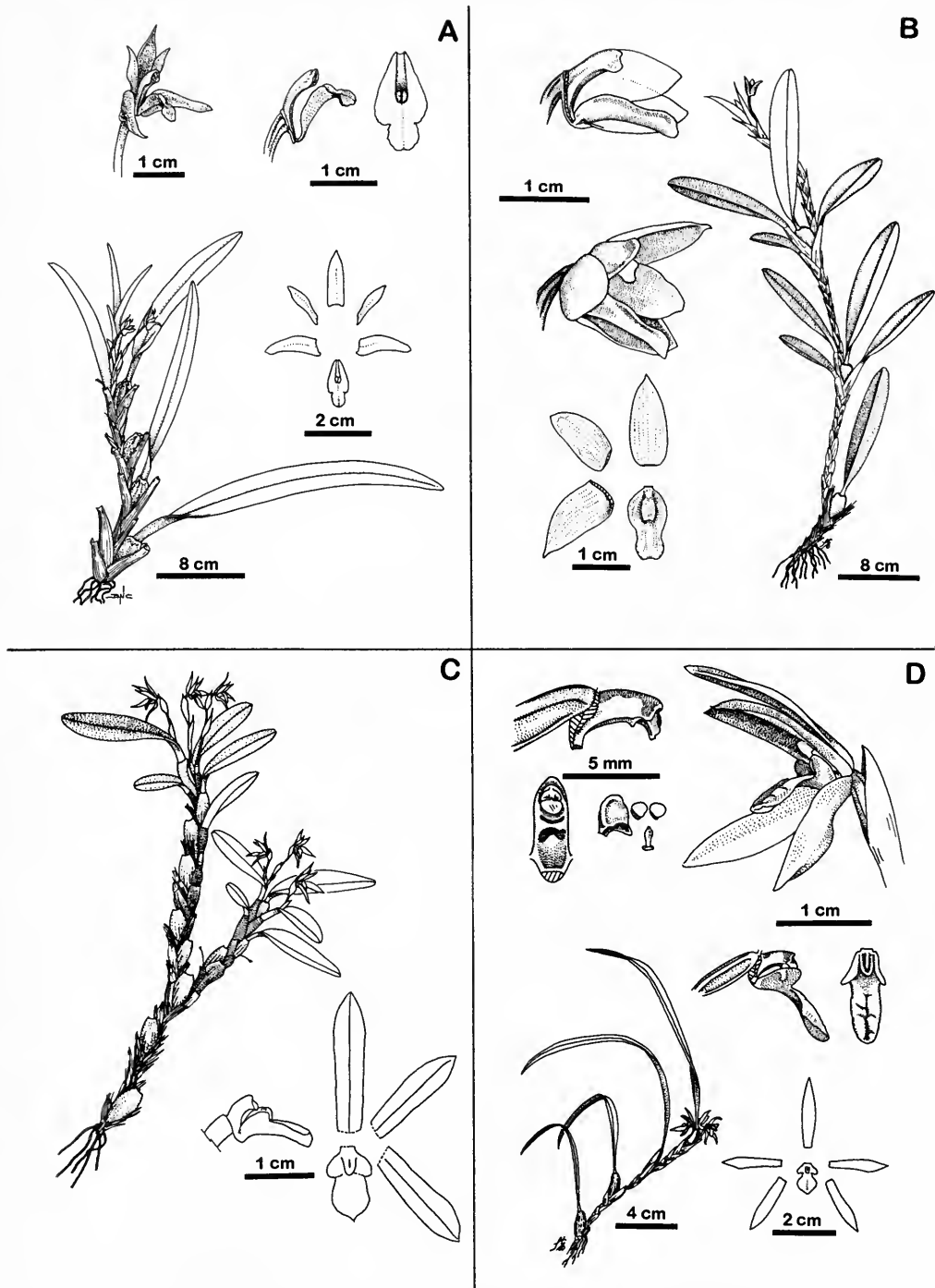


FIG. 16. A, *Maxillaria anceps* (Icon. Pl. Trop. 14: t. 1335. Illustrator: B. N. Culbertson). B, *M. diuturna* (illustrator: S. Dalström). C, *M. bracteata* (illustrators: plant habit, S. Dalström; floral diagnosis, Lindleyana 9:240, J. T. Atwood). D, *M. gomeziana* (illustrator: S. Dalström).

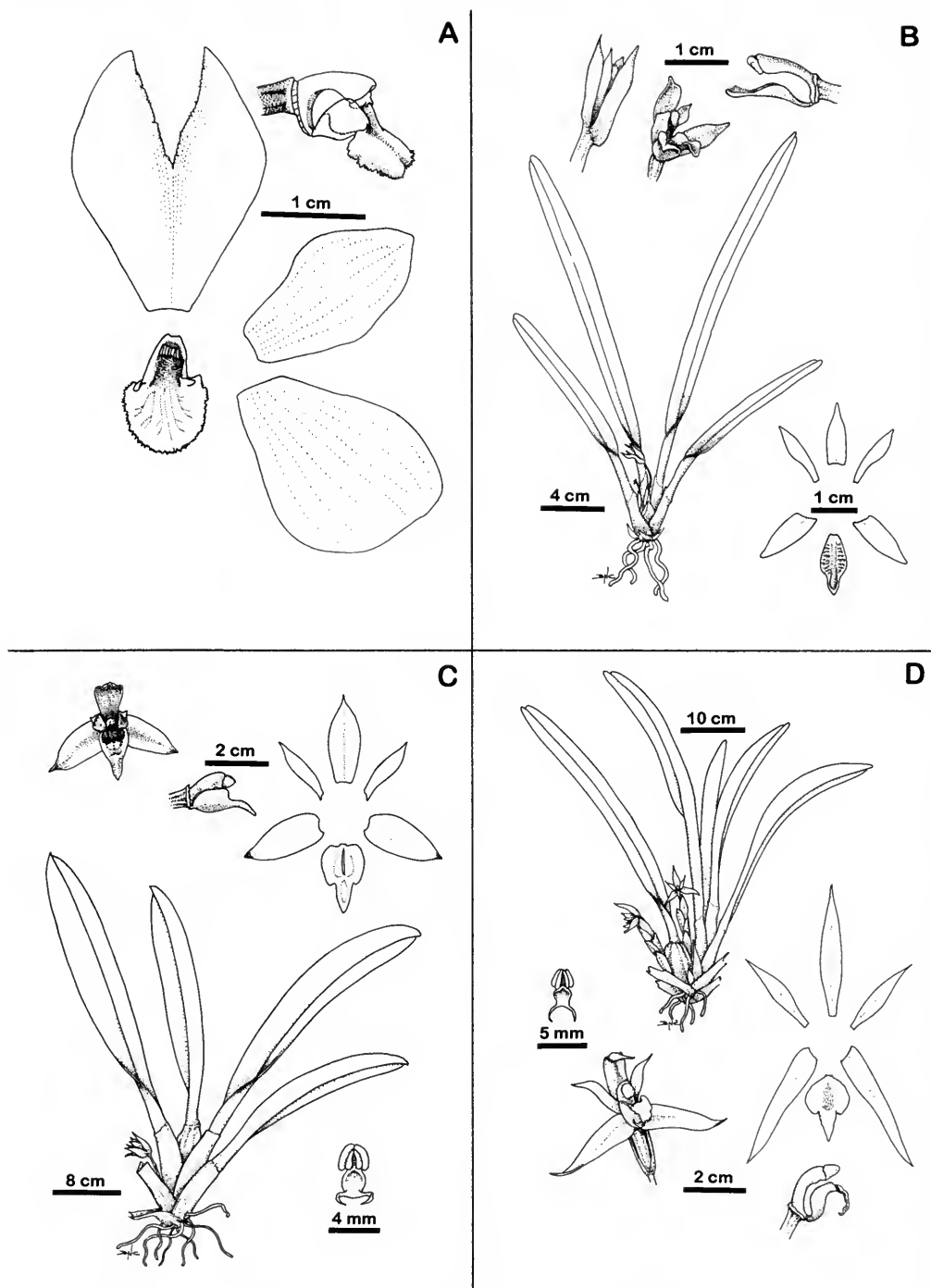


FIG. 17. A, *Maxillaria serrulata* (illustrator: S. Dalström after J. T. Atwood). B, *M. crassifolia* (Icon. Pl. Trop. 14: t. 1341. Illustrator: B. N. Culbertson). C, *M. maleolens* (Icon. Pl. Trop. 14: t. 1351. Illustrator: B. N. Culbertson). D, *M. nasuta* (Icon. Pl. Trop. 14: t. 1354. Illustrator: B. N. Culbertson).

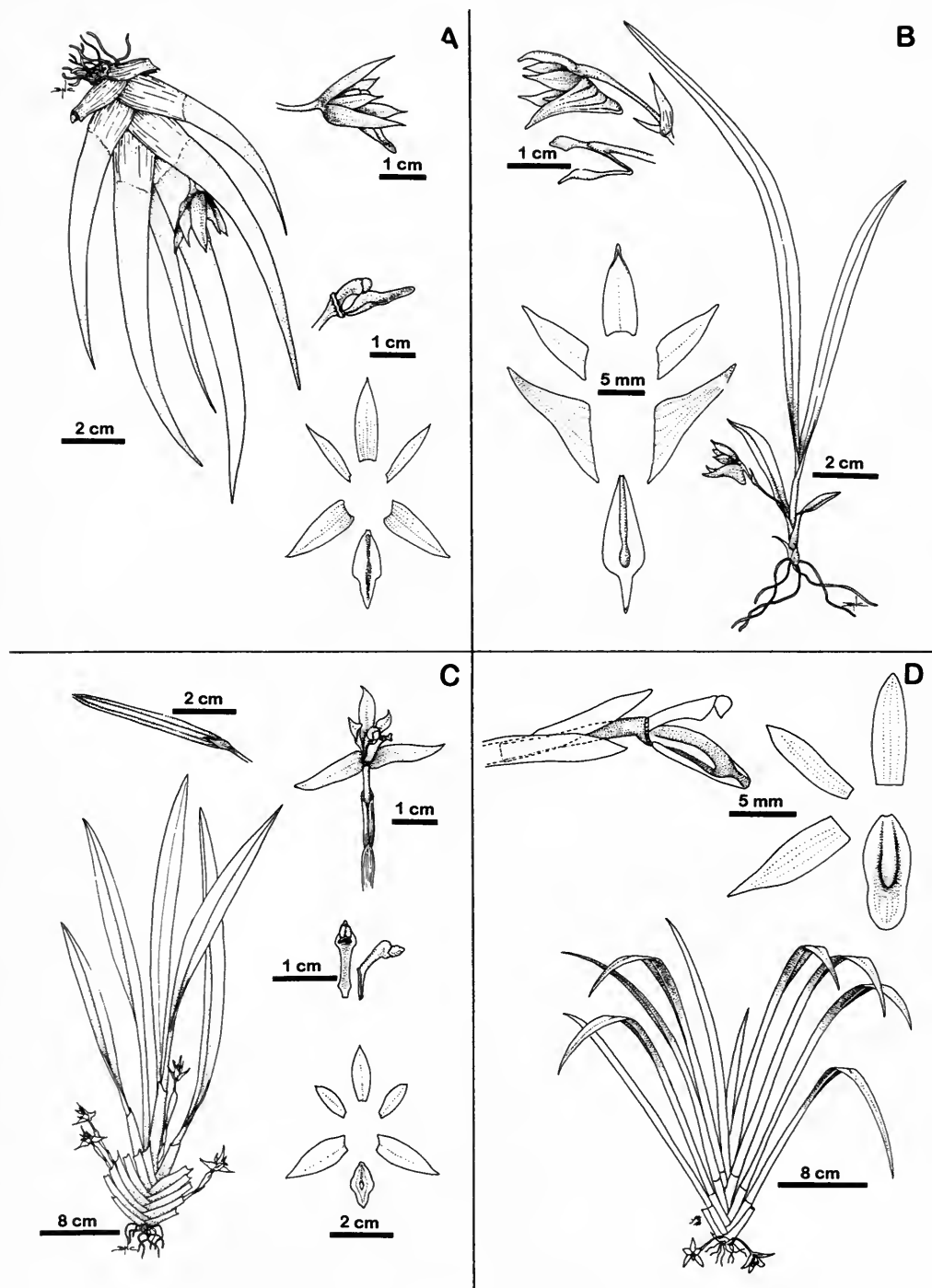


FIG. 18. A, *Maxillaria valenzuelana* (Icon. Pl. Trop. 14: t. 1370. Illustrator: B. N. Culbertson). B, *M. angustissima* (Icon. Pl. Trop. 14: t. 1337. Illustrator: B. N. Culbertson). C, *M. chartacifolia* (Icon. Pl. Trop. 14: t. 1340. Illustrator: B. N. Culbertson). D, *M. bicallosa* (illustrator: S. Dalström).

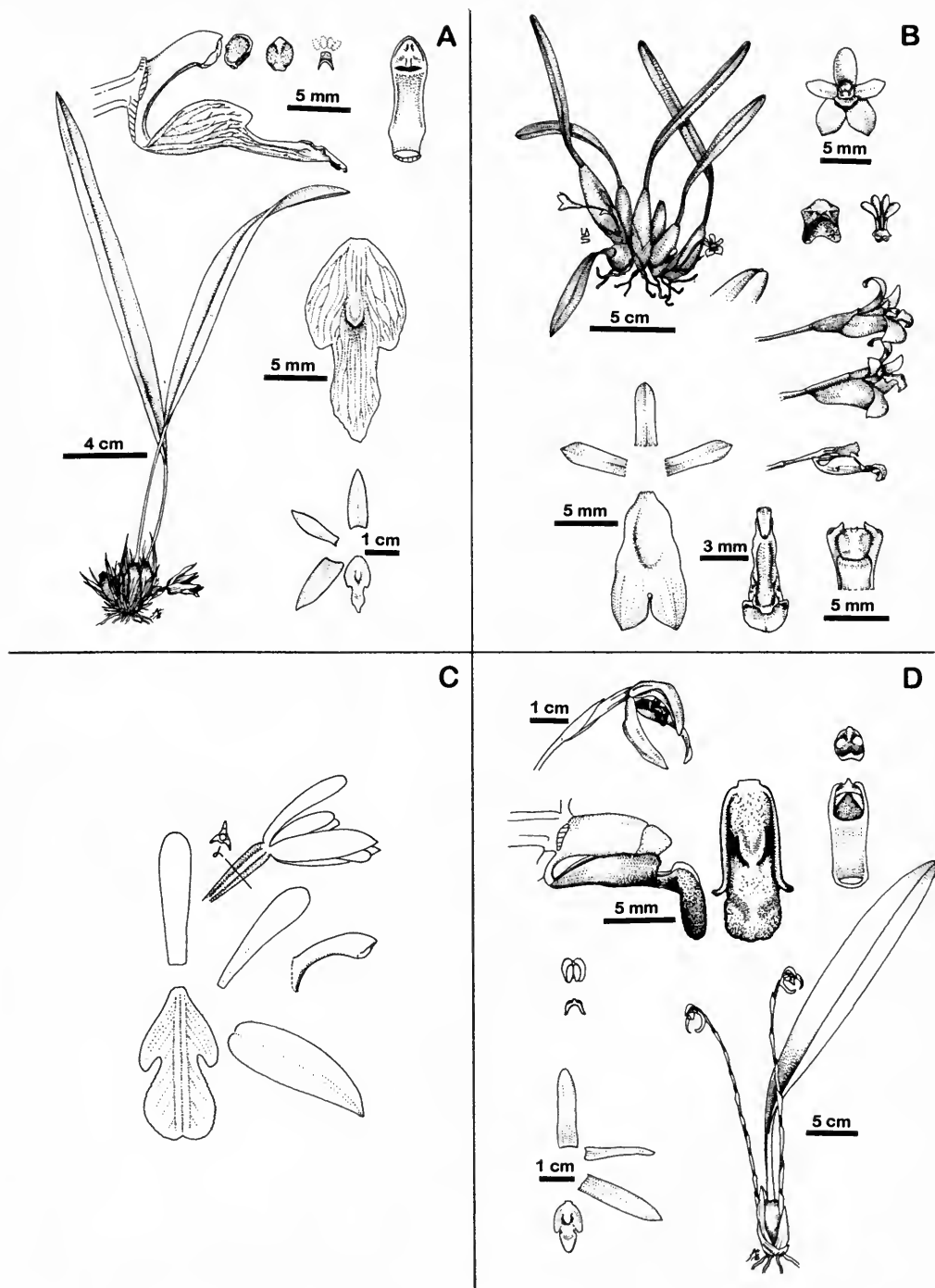


FIG. 19. A, *Maxillaria longipetiolata* (Icon. Pl. Trop. 16: t. 1563. Illustrator: S. Dalström). B, *M. strumata* (illustrator: L. Alfaro). C, *M. piestopus* (illustrator: S. Dalström after J. T. Atwood). D, *M. longiloba* (Icon. Pl. Trop. 16: t. 1562. Illustrator: S. Dalström).

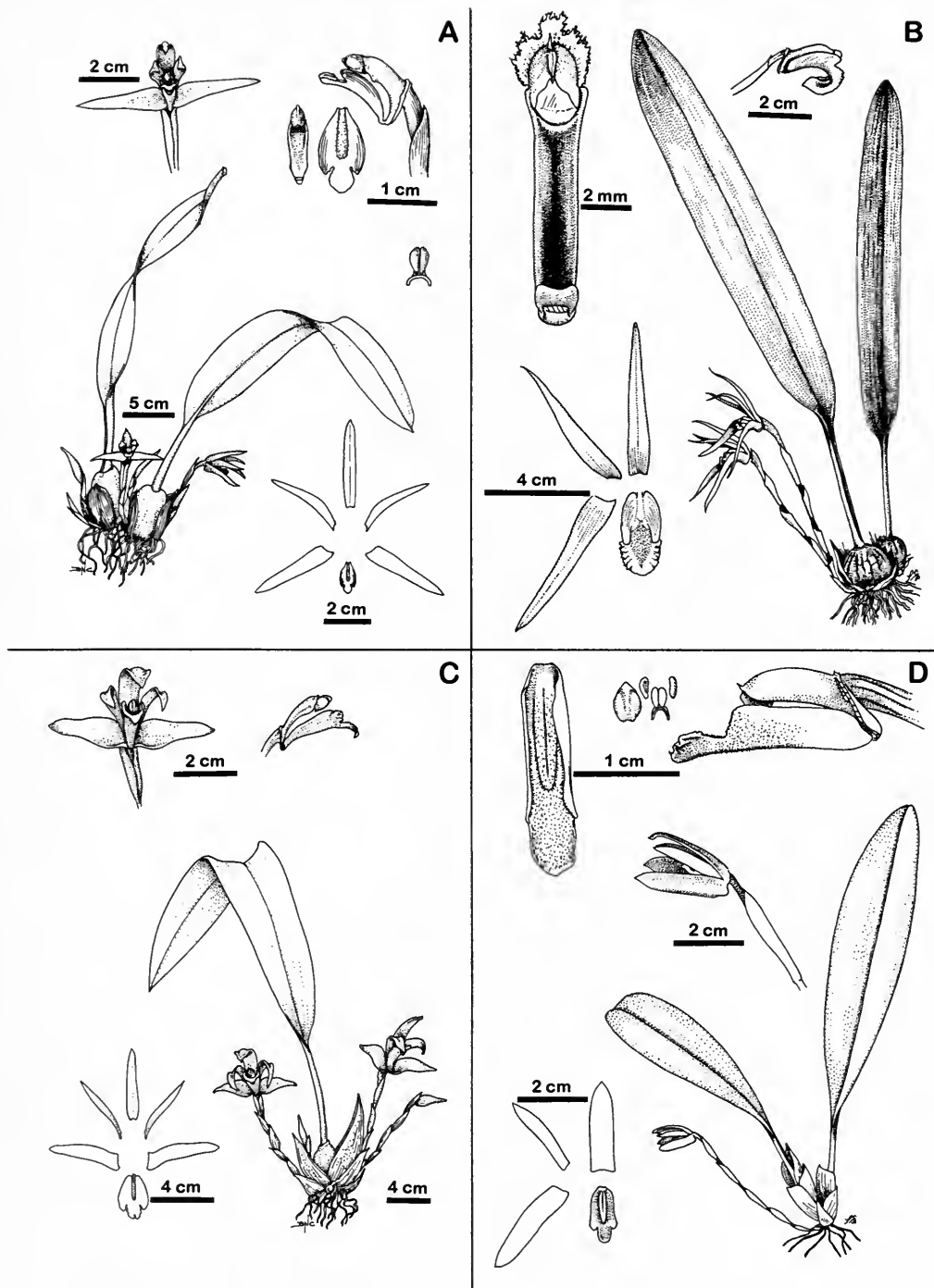


FIG. 20. A, *Maxillaria ringens* (illustrator: S. Dalström). B, *M. endresii* (Icon. Pl. Trop. 14: t. 1345. Illustrator: S. Dalström). C, *M. angustisegmenta* (Icon. Pl. Trop. 14: t. 1336. Illustrator: B. N. Culbertson). D, *M. cryptobulbon* (illustrator: S. Dalström).

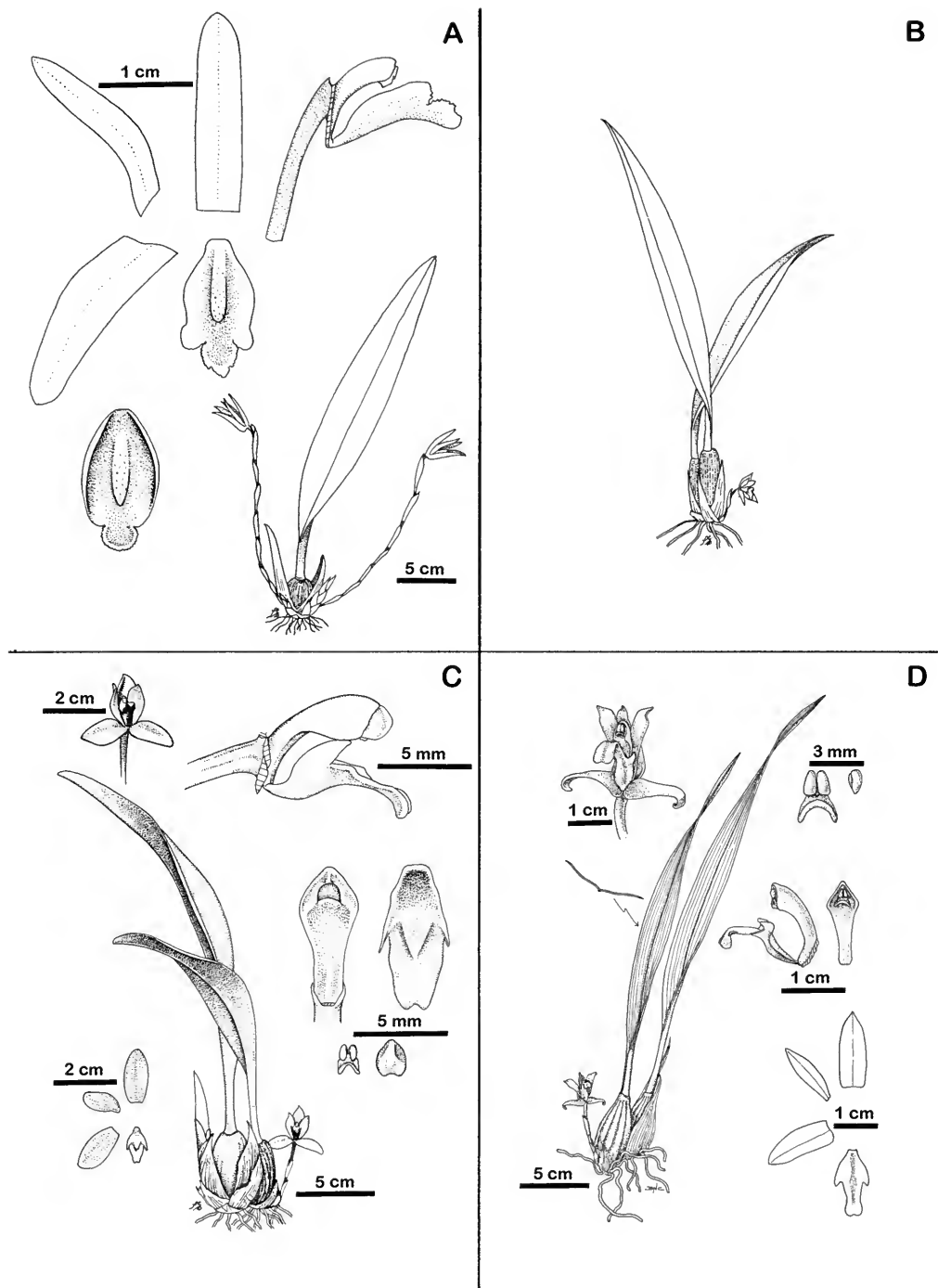


FIG. 21. A, *Maxillaria brunnea* (illustrator: S. Dalström). B, *M. acutifolia* (illustrator: S. Dalström). C, *M. hedwigiae* (illustrator: S. Dalström). D, *M. dressleriana* (illustrator: B. N. Culbertson).

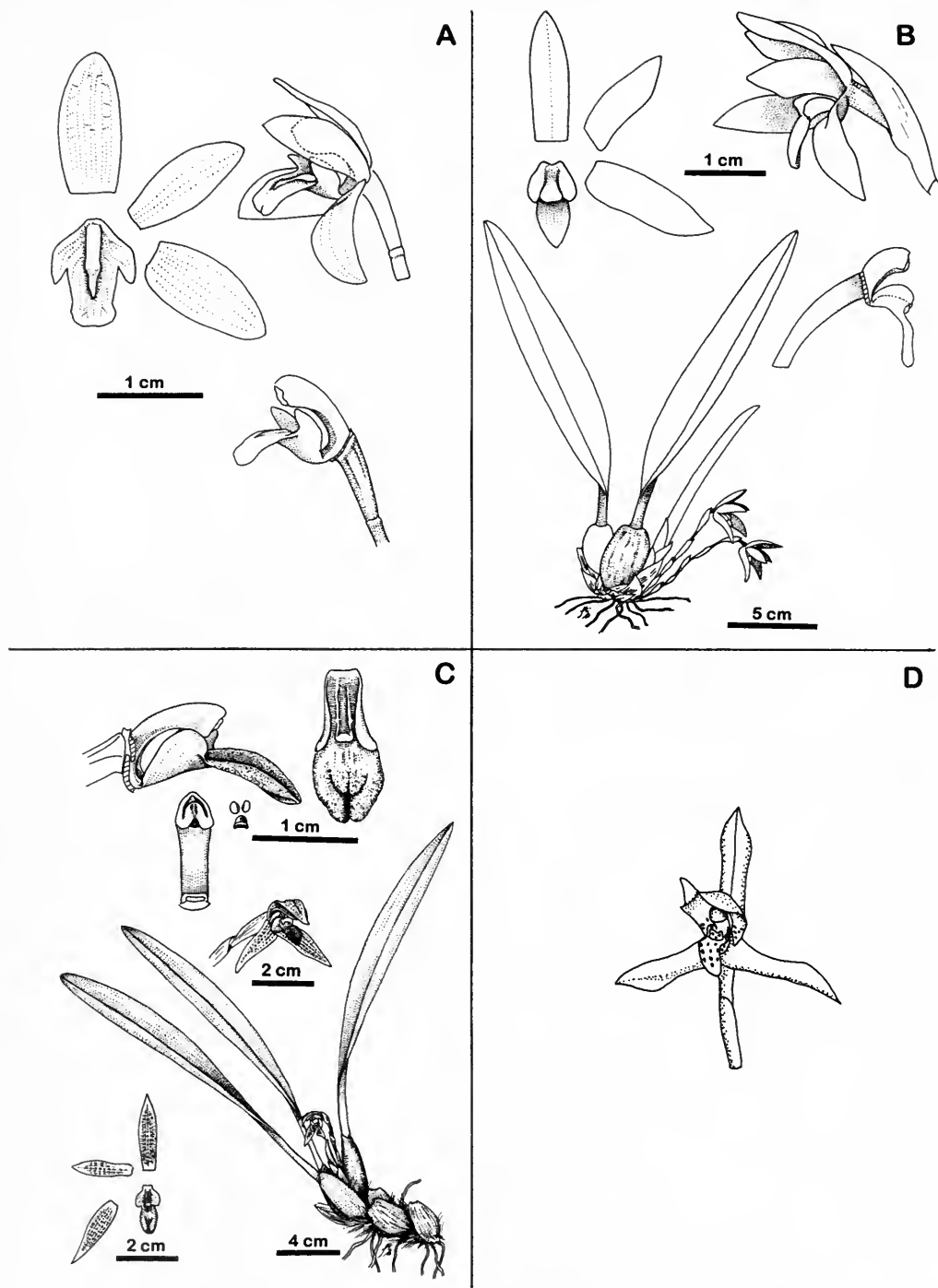


FIG. 22. **A**, *Maxillaria moralesii* (Lindleyana 11:31. 1996. Illustrator: B. N. Culbertson). **B**, *M. obscura* (illustrator: S. Dalström). **C**, *M. punctostriata* (illustrator: S. Dalström). **D**, *M. cedralensis* (illustrator: J. T. Atwood).

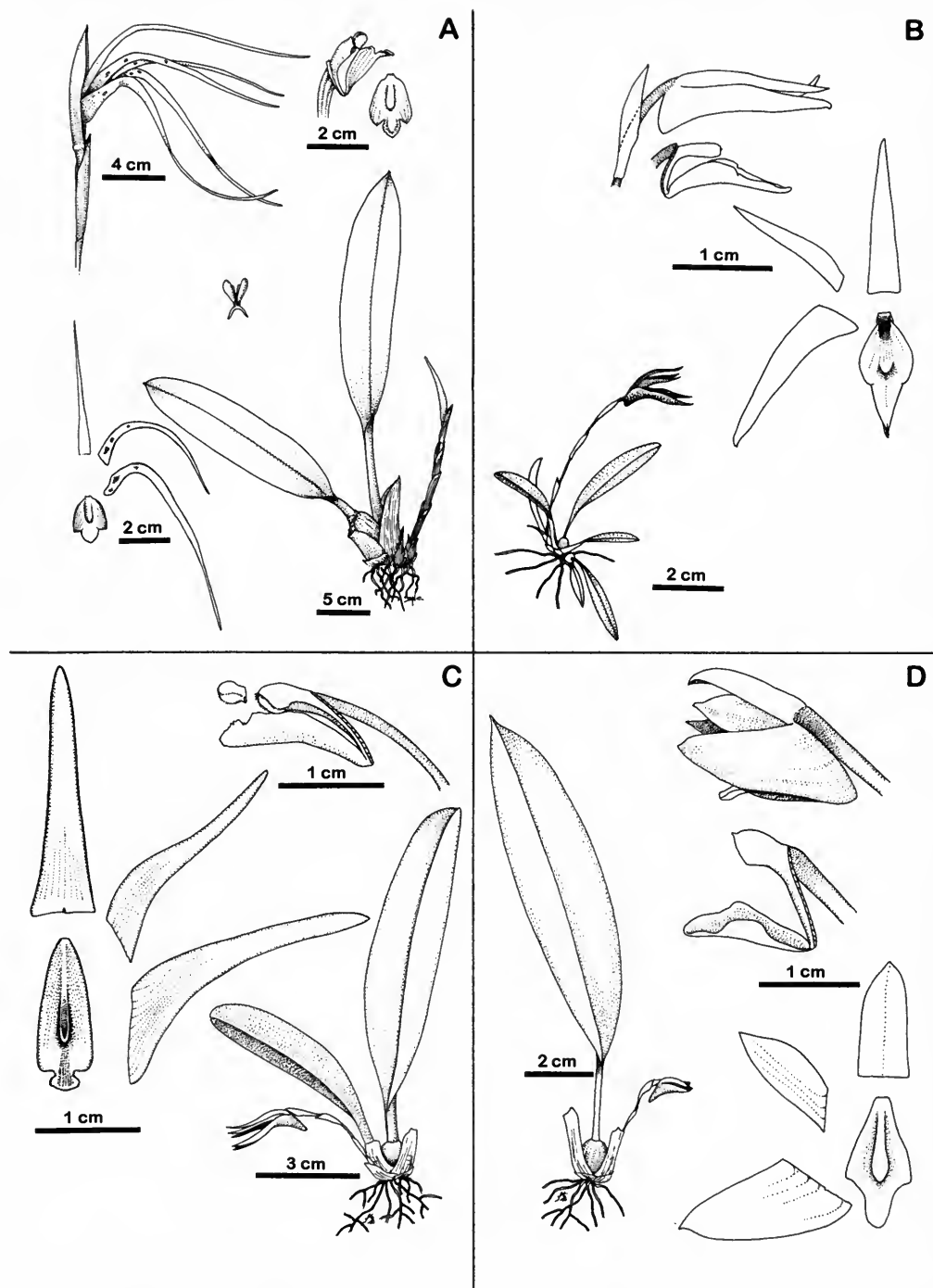


FIG. 23. A, *Maxillaria rodrigueziana* (Icon. Pl. Trop. 14: t. 1361. Illustrator: B. N. Culbertson). B, *M. attenuata* (illustrator: S. Dalström). C, *M. confusa* (illustrator: S. Dalström). D, *M. ramonensis* (illustrator: S. Dalström).

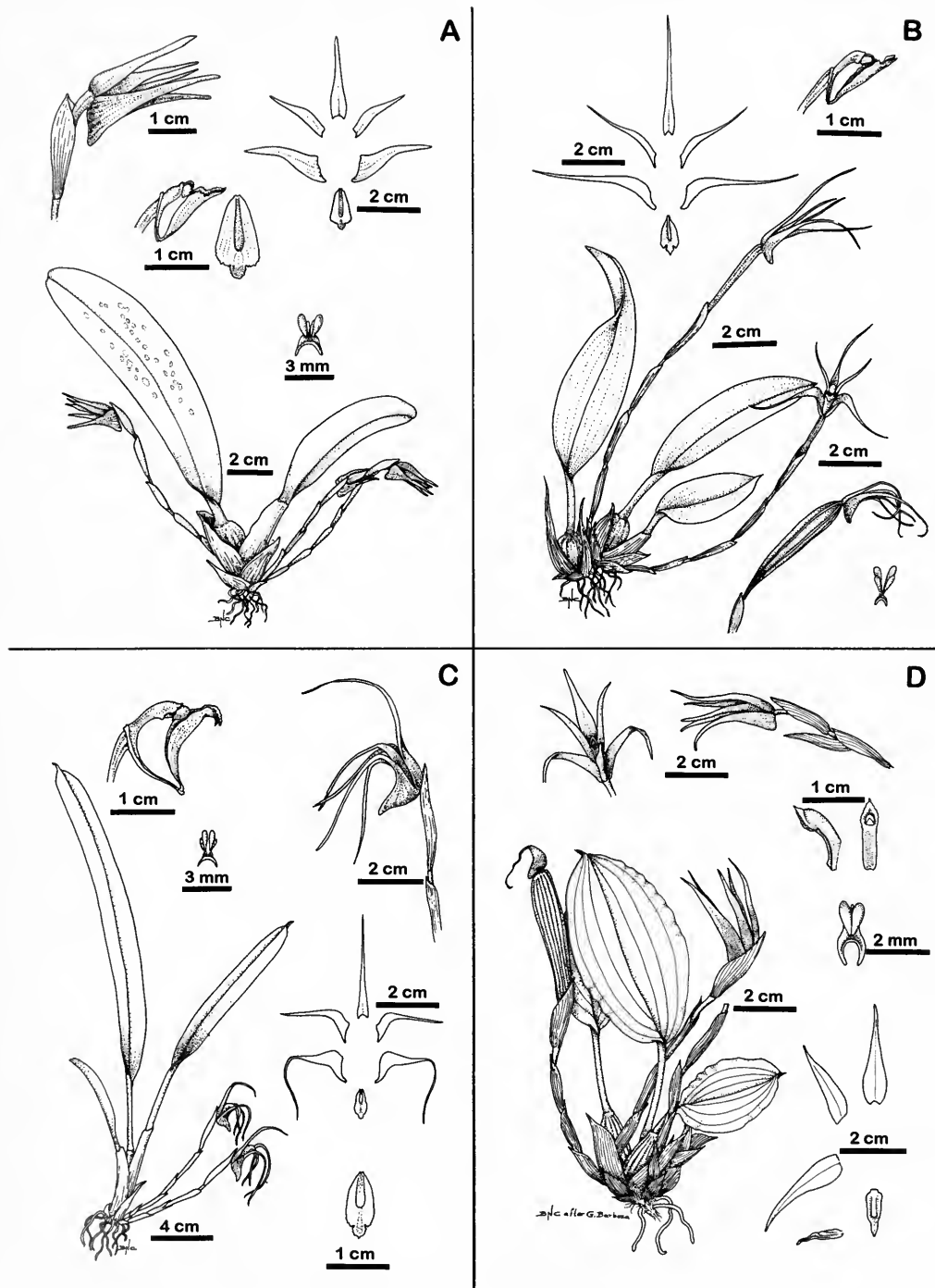


FIG. 24. **A**, *Maxillaria reichenheimiana* (Icon. Pl. Trop. 14: t. 1359. Illustrator: B. N. Culbertson). **B**, *M. pachyacron* (Icon. Pl. Trop. 14: t. 1357. Illustrator: B. N. Culbertson). **C**, *M. arachnitiflora* (Icon. Pl. Trop. 14: t. 1338. Illustrator: B. N. Culbertson). **D**, *M. chionantha* (Selbyana 16:242. Illustrator: B. N. Culbertson after G. Barboza).

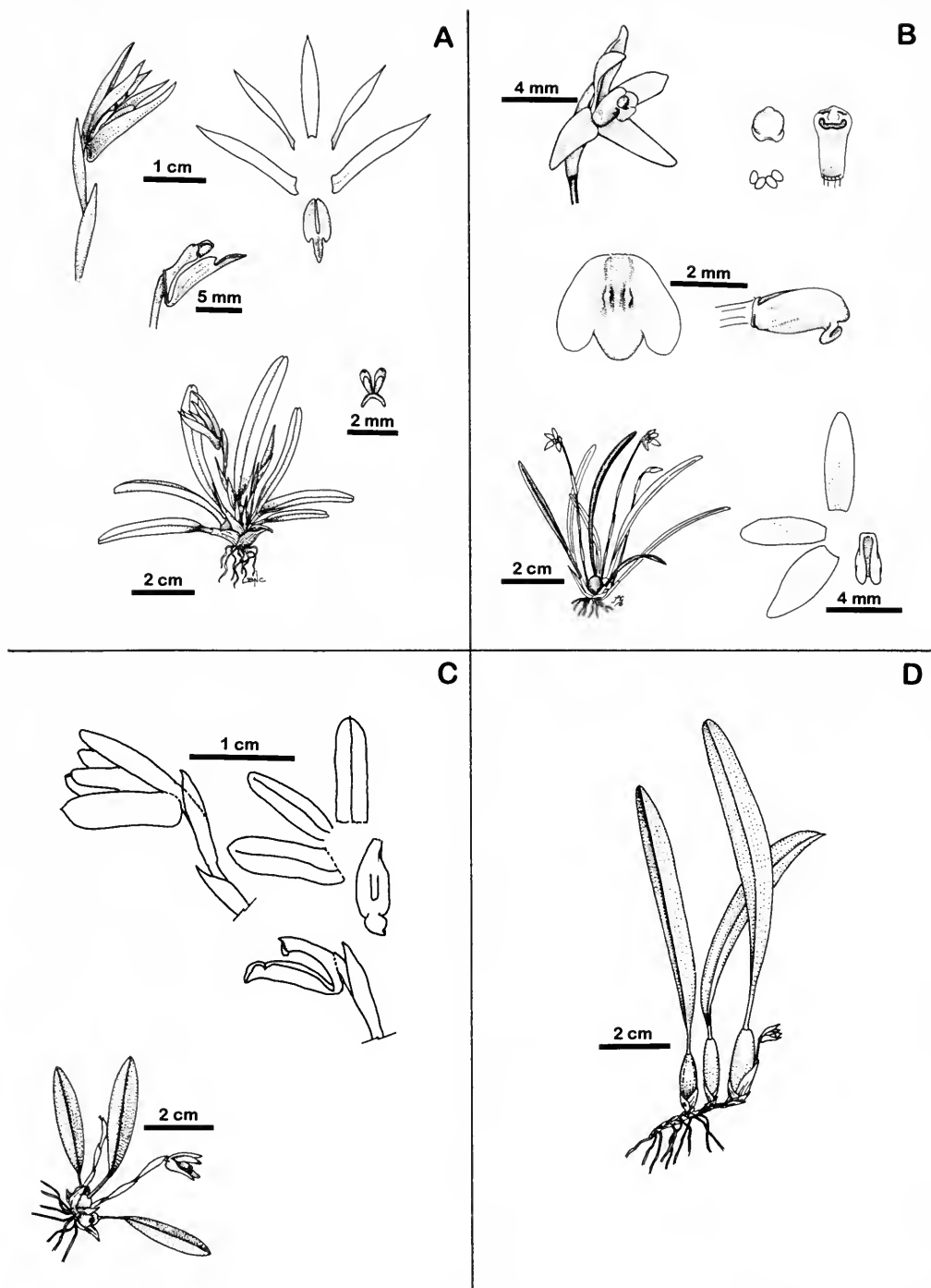


FIG. 25. **A**, *Maxillaria brachybulbon* (Icon. Pl. Trop. 14: t. 1339. Illustrator: B. N. Culbertson). **B**, *M. vittariifolia* (Icon. Pl. Trop. 14: t. 1372. Illustrator: S. Dalström). **C**, *M. acostae* (illustrators: plant habit, S. Dalström; floral diagnosis, J. T. Atwood). **D**, *M. caespitifica* (illustrator: S. Dalström, based on a Nicaraguan collection [Atwood 6978]).

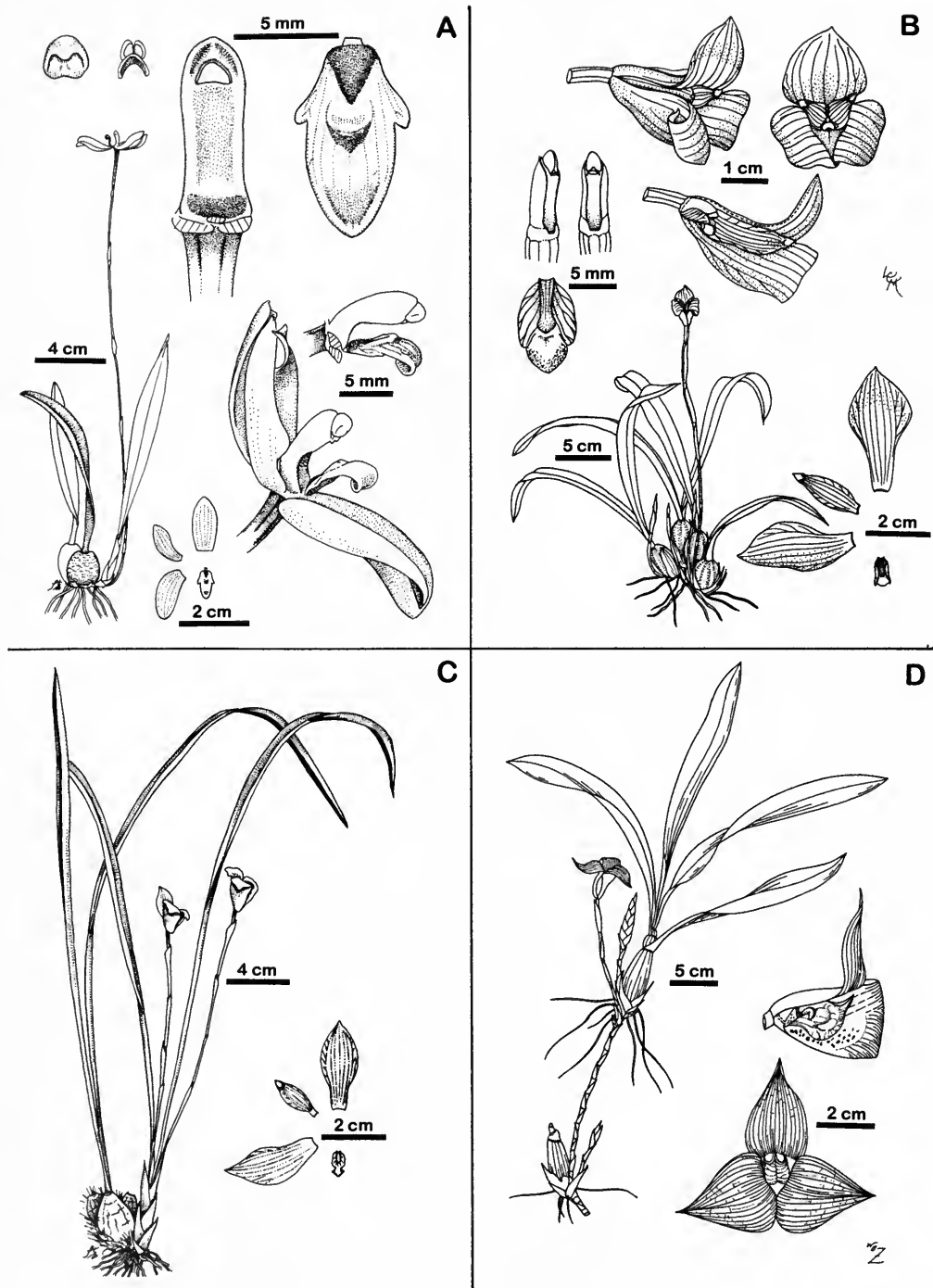


FIG. 26. **A**, *Mormolyca ringens* (illustrator: S. Dalström). **B**, *Trigonidium egertonianum* (Icon. Pl. Trop. 4: t. 345. Illustrator: L. Megahee). **C**, *T. riopalenquense* (Icon. Pl. Trop. 14: t. 1399. Illustrator: S. Dalström). **D**, *T. lankesteri* (Icon. Pl. Trop. 4: t. 346. Illustrator: W. B. Zomlefer, based on an Ecuadorian plant probably misdetermined as *T. insigne* Rchb. f. ex Benth. & Hook.).

- 4a. Leaves (8)10–16(20) mm wide, leaf apex with longer lobe exceeding the shorter by (2)3–5(12) mm *C. latifolium*
- 4b. Leaves (3)5–6(8) mm wide, leaf apex with longer lobe exceeding the shorter by 0.5–1.5 mm 5
- 5a. Inflorescence with 3–4(5) internodes, the floral bract comprising $\frac{1}{3}$ – $\frac{1}{2}$ of total inflorescence length; bracts of the inflorescence somewhat inflated; perianth segments clear green or yellow-green, usually not tinged with other colors *C. calcaratum*
- 5b. Inflorescence with (5)6–11 internodes, the floral bract comprising $\frac{1}{10}$ – $\frac{1}{4}$ ($\frac{1}{2}$) of total inflorescence length; inflorescence bracts all tubulose; flowers dull green tinged with brown or maroon *C. lehmannii*

Cryptocentrum calcaratum (Schltr.) Schltr., Orchideen 449. 1914. *Pittierella calcarata* Schltr., Repert. Spec. Nov. Regni Veg. 3:80–81. 1907. TYPE: Costa Rica, Province of Alajuela, La Palma, A. Tonduz 9682 (holotype: B, destroyed; drawing at AMES). Figure 1C.

Epiphytic **herb** (5)8–20(28) cm tall, monopodial, rarely branching from the base; stems (1)2–7(10) cm long, usually erect, distichously 4–8-leaved at the apical $\frac{1}{2}$, basal $\frac{1}{2}$ covered with defibrating leaf sheaths and decurrent roots that give it a pseudobulbous appearance. **Leaves** coriaceous, flat or somewhat convex or concave, straight or arcuate, midnerve shallowly sulcate on ventral surface, slightly keeled on dorsal surface especially toward apex, (4)5–15(20) cm long, (4)6–11(12) mm wide; sheath 1–2 cm wide; blades oblong-elliptic to narrowly oblong-elliptic, apex obtuse to subacute, asymmetrically 2-lobulate; margins and keel erose. **Inflorescence** (2)3–6 cm long, much shorter than the leaves, 1–3(5) appearing simultaneously from the rooting zone, erect, sheathed with inflated and dorsally sharply keeled bracts; ovary with pedicel smooth or somewhat verruculose, (26)30–36(38) mm long, subterete, straight, subtended by a subequal floral bract. **Flowers** spreading, greenish or yellowish green, the segments rarely suffused with purple or brownish apically. **Sepals** subfleshy, flat or with margins slightly involute, obtuse to rarely acute; dorsal narrowly triangular, narrowly oblong-elliptic to narrowly elliptic, 9–15 mm long, (3.5)4–5(6) mm wide; lateral sepals narrowly lanceolate to narrowly elliptic-lanceolate, 12–16 mm long, 3.5–5 mm wide; tube 4–5 mm long, 2.5–3 mm thick, fusiform to broadly fusiform-obconic; sepaline spur 22–32 mm long, cylindric, straight. **Petals** narrowly truncate to truncate-elliptic, (9)10–15(17) mm long, 2.5–4 mm wide, the basal section contained in the sepaline tube, concave; bent portion 5–11 mm long starting ca. 2 mm above the mouth of the sepaline tube, 2.5–3.5 mm wide at base, apex obtuse to subacute, margins flat or somewhat revolute. **Lip** laxly covered with long white or greenish hairs in some clones, sigmoid in profile, 6–9 mm long, 4.5–5 mm wide when spread; hypochile broadly elliptic to suborbicular when expanded, 4–5 mm long, 2–3 mm deep; epichile fleshier than hypochile, conduplicate-concave, lanceolate to lanceolate-triangular, 3–4 mm long, 1.5–2 mm wide, obtuse to subacute. **Column** stout, 2.5–3.5 mm long, flanked by dolabriform wings for $\frac{3}{4}$ of its length, anterior margins of the wings projected forward; anther ca. 2 mm long, ventrally with a pair of retrorse teeth; pollinia 4, ellipsoid. **Cap-sule** ellipsoid or oblongoid, 2.5–3.2 cm long.

Apparently restricted to open places at the forest edges or high on trees within cloud forests at 1000–2400 m. Flowering mostly July to October. Costa Rica and adjacent Panama. Frequent on pasture trees at the Monteverde Reserve in the Cordillera de Tilarán but rather rare in southeastern Costa Rica and Panama.

Cryptocentrum flavum Schltr., Repert. Spec. Nov. Regni Veg. 12:214. 1913. TYPE: Colombia, Cauca, Córdoba, Dagua Valley, Pacific coastal zone, 30–100 m, H. Pittier 591 (holotype: US).

Plant an epiphytic herb, erect or ascendent, monopodial, often branching with age, 4–8 cm tall. Stem basally enveloped by decurrent roots, leaf arrangement polystichous. **Leaves** straight or slightly recurved, usually speckled with dull red-maroon, linear or linear-oblong, hemicylindric or subtriquetrous in cross section, obscurely keeled beneath, (30)40–60(70) mm long, 1.5–2.5 mm wide; apex obtuse to acutely obtuse, microscopically mucronulate; margins and keel microscopically erose. **Inflorescence** erect, spreading, or descending, subequal or slightly longer than the subtending leaves, 1–2(4) appearing simultaneously from the lower stem, (1.5)3–6(7) cm long, bracts much shorter than the internodes, tubulose; ovary with pedicel green tinged with red-maroon, subterete, (8)10–14.5(16) mm long, subtended by a floral bract 5–7 mm long and enclosing only the apical $\frac{1}{10}$ – $\frac{1}{3}$ of the spur. **Flowers** greenish or dull ochre-yellow, often tinged with dull red-maroon toward the bases of the perianth segments, subcampanulate or with perianth segments spreading to an angle of 45–80°. **Sepals** somewhat fleshy, convex, often with recurved margins; dorsal narrowly lanceolate to lanceolate or oblong-lanceolate, 5–7 mm long, 1.3–2.1 mm wide, obtuse to obtusely acute; lateral sepals narrowly lanceolate to lanceolate, 5–6 mm long, 1.3–2 mm wide, obtuse or acute; tube broadly obconic, broadly 3-keeled, 1–1.5 mm thick; sepaline spur cylindric, broadly and obscurely clavate, straight, rarely somewhat curved, 12–14.5 mm long. **Petals** narrowly lanceolate to lanceolate, 6–8.5 mm long, 1.5–2 mm wide; basal section shallowly concave and projecting well beyond the sepaline cup for 1.5–2 mm; bent portion fleshier than the basal portion, bending angle 35–45°, 3–5 mm long, 1–1.3 mm wide at base, apex acute and acuminate. **Lip** sigmoid in profile,

6–7.5 mm long, 2.5–2.7 mm wide when spread; hypochile shallowly saccate, elliptic when expanded, 4 mm long, 1–1.2 mm deep; epichile straight or slightly down-flexed, bending angle 0–45°, narrowly triangular to triangular-lanceolate, 3.2–4 mm long, 1.5–1.8 mm wide at base, acuminate. **Column** dorsally flat or convex, ventrally flanked by dolabriform wings for $\frac{1}{4}$ – $\frac{2}{3}$ its length, 2.4–2.6 mm long, 1.3–1.5 mm thick; anther ca. 1 mm long and tall, ventrally with an obscure pair of teeth, 0.2–0.3 mm long. **Capsule** 1.5–2 cm long.

Epiphytic in tropical wet to cloud forests at 0–1650 m. Flowering in Costa Rica little known; elsewhere apparently throughout the year. Extreme southeastern Costa Rica to Ecuador.

Cryptocentrum flavum and closely related *C. standleyi* are easily recognized by the small stature of the plants but are difficult to distinguish from each other, especially in dried specimens. Plants of *C. flavum* usually have longer leaves that are also thicker, straighter, and stiffer. The stems of *C. flavum* are always shorter than those of *C. standleyi* for an equivalent number of internodes. The spur of *C. flavum* is 12–15 mm long but rarely as short in *C. standleyi*.

Cryptocentrum gracillimum Ames & C. Schweinf., Sched. Orch. 8:68. 1925. TYPE: Costa Rica, Cartago, Pejivalle, 2300 ft, 16 May 1924, *Lankester 866* (holotype: AMES).

Plant an epiphytic herb, erect, 7–15 cm tall, monopodial but older plants producing 1–many lateral offsets and then plants densely caespitose. Stems enveloped by decurrent roots basally, apically by leaf sheaths. **Leaves** hemicylindric, linear, (4)5.5–10(15) cm long, 2–2.5 mm thick, adaxially shallowly concave, abaxially convex with no raised midvein; apex obtuse (acute in dried specimens), unequally 2-lobate; margins erose; sheaths 5–12 mm long, ca. 5 mm wide, multinerved. **Inflorescences** appearing simultaneously from the rooting zone, erect or horizontally spreading, 4–9 cm long; peduncle terete but the last internode obscurely compressed, sheathed with conduplicate dorsally keeled bracts; ovary with pedicel 17–21 mm long, laxly covered with microscopic glandular hairs, subtended by a floral bract 19–24 mm long, spatheaceous and inflated, open only at the apex, enclosing the spur and covering the floral tube partially or totally. **Flowers** with widely spreading segments, pale greenish yellow, green, dull olivaceous, or dull tan-brown. **Sepals** subfleshy, oblong-elliptic, obtuse, margins revolute; dorsal 8–10 mm long, 2.5–3.1 mm wide; laterals 8–10 mm long, 2.3–2.8 mm wide; sepaline cup fusiform-obconic, 2–3 mm long, 1.9–2.5 mm thick; sepaline spur cylindric, only obscurely clavate, 13.5–19 mm long. **Petals** narrowly lanceolate, acute, long acuminate, 8.3–10 mm long, 1.9–2.1 mm wide; bent portion 4–5 mm long, starting well above the mouth of the sepaline cup, bending angle 45–90°. **Lip** sigmoid in profile, 7–8 mm long, 2.8–3.2 mm wide when expanded, throat with a few white hairs; hypochile broadly elliptic

to ovate, with 3 thick nerves and 2 thinner outer ones, margins straight; epichile narrowly lanceolate, 3-nerved, down-flexed, bending angle 45–90°, 4–5 mm long. **Column** arcuate, 2.1–3 mm long, ca. 1.5 mm thick, flanked by dolabriform wings for $\frac{2}{3}$ its length; anther 1–1.2 mm long, 1.2–1.5 mm tall, ventrally with a pair of retrorse teeth; pollinia ellipsoid, dull cream-yellow.

A rare epiphyte within its range growing in either bright or shady conditions at 500–1000 m. Flowering May to December. Endemic to the Central Valley of Costa Rica; replaced in Panama by an undescribed species.

The hemiterete leaves on an abbreviated distichous-leaved stem are good field characters for recognition.

Cryptocentrum latifolium Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:247. 1923. TYPE: Costa Rica, Alajuela, Las Angeles de San Ramon, A. Brenes 56 (holotype: B, destroyed; lectotype: drawing at AMES). Figure 1B.

Plant an epiphytic herb, occasionally growing on road banks or rocks, monopodial, erect or horizontally spreading, rarely producing basal offshoots, (7)12–20(30) cm tall. Stems covered basally by decurrent roots, apically by leaf sheaths. **Leaves** distichous, conduplicate, fleshy-coriaceous, linear-oblong to narrowly oblong-obovate, erect to arcuate, flat to adaxially convex, 5–20(30) cm long, (8)10–16(20) mm wide; apex obtuse to subrounded, strongly unequally 2-lobate, obscurely keeled, margins erose, especially toward apex. **Inflorescences** to as long as the leaves, usually shorter, (4)6–13(20) cm long, appearing simultaneously from the rooting zone, erect or horizontally spreading or pendent; peduncle stout, bracts subequal to the internodes; ovary with pedicel 28–35 mm long, subterete, laxly to subdensely covered with glandular hairs; subtended by a floral bract 30–42 mm long, somewhat inflated, totally enclosing the ovary and spur and occasionally the base of the dorsal sepal. **Flowers** among the largest in the genus with widely spreading perianth segments, greenish brown or yellow-green, often heavily tinged with maroon, or totally maroon. **Sepals** fleshy, obtuse to acute, subapically mucronulate to conspicuously mucronate, margins revolute, especially the laterals; dorsal lanceolate to elliptic-lanceolate, 15–20 mm long, 5–8 mm wide; lateral sepals oblong to narrowly oblong-elliptic, 18–30 mm long, 3.5–5.5 mm wide; tube cylindric to broadly cylindric-obconic, 2–3 mm long; sepaline spur cylindric, not clavate or obscurely so, 26–30 mm long. **Petals** elliptic to broadly elliptic, 10–16 mm long, 4–5.5 mm wide, the basal section included in the sepaline cup, concave; bent portion 5–7.5 mm long, 3–5.5 mm wide at the base, conspicuously fleshier than basal portion, bending angle 90–180°. **Lip** sigmoid in profile, 8–12 mm long, 4.5–6 mm wide when expanded; hypochile broadly elliptic to rounded when expanded, 4.5–5.5 mm long, 2.5–3 mm deep, margins straight; epichile triangular to broadly ovate, 2.5–3.5 mm long. **Column** 3–4 mm long, ca. 2 mm thick, dorsally slightly arcuate,

flanked by dolabriform wings for $\frac{2}{3}$ its length; anther 1.8–2.2 mm long, ventrally with a pair of retrorse teeth. **Capsule** 30–40 mm long, ellipsoid.

Epiphytic on larger branches in very humid to moist forests at 0–1500 m. Flowering June to October. Costa Rica to Ecuador.

Cryptocentrum latifolium is the largest species in the genus and has the largest flowers, although small plants start flowering when they could be confused with other species. The broad, very unequally 2-lobate leaf apex is unique, with the longer lobe exceeding the shorter by (2)3–5(12) mm.

Cryptocentrum lehmannii (Rchb. f.) Garay, Bot. Mus. Leaf. 18:209. 1958. *Aeranthus* (*Cryptoplectri*) *lehmannii* Rchb. f., Otia Bot. Hamb. 10. 1878. TYPE: Ecuador, Tungurahua, Volcán Tungurahua, Baños, 7400 ft (2320 m), Mar. 1877, F. Lehmann 601 (w). *Campylocentrum lehmannii* (Rchb. f.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 8: 164. 1921. (sphalm). *Cryptocentrum jamesonii* Benth., Gen. Pl. 557. 1883. TYPE: Ecuador, Pichincha, *Jameson s.n.* (holotype: κ). *Cryptocentrum gracilipes* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:246. 1923. TYPE: Costa Rica, Alajuela, Los Angeles de San Ramón, *Brenes 37* (holotype: B, destroyed). Figure 1D.

Plant an epiphytic monopodial herb (8)12–25(30) cm tall, rarely branching from the base. Stems erect, basal $\frac{1}{2}$ covered with filiferous leaf sheaths and decurrent roots, distichously 5–8-leaved apically. **Leaves** coriaceous to somewhat fleshy, flat or somewhat convex or concave, arcuate or stiffly erect, linear to linear-elliptic, (5)10–20(25) cm long, (1.5)3–9(12) mm wide; apex obtuse to acute, unequally 2-lobate. **Inflorescences** rarely exceeding the leaves, 1–4(6) appearing simultaneously from the rooting zone, arcuate or horizontally spreading to erect, (4)5.5–12(15) cm long; peduncle with bracts shorter to somewhat longer than the internodes; ovary with pedicel (15)22–30 mm long, subtended by a floral bract reaching and enclosing the dorsal section of the tube. **Flowers** with perianth segments opening to an angle of 70–90°, dark green with dark reddish or purplish tinge. **Sepals** somewhat fleshy, lanceolate or oblong-lanceolate, acute to subobtuse, with margins usually revolute; dorsal 8–15(20) mm long, 3–6 mm wide; lateral sepals often somewhat oblique, (10)12–20(22) mm long, (3)4–6 mm wide; sepaline cup broadly obconic, obscurely keeled, 2–3(3.5) mm long and thick; sepaline spur cylindric to strongly clavate, straight, (10)15–27 mm long. **Petals** trullate-elliptic, (8)12–16(18) mm long, the basal section contained in the sepaline tube, concave; bent portion 5–9 mm long, margins somewhat or strongly revolute, bending angle 45–90°. **Lip** sigmoid in profile, 6–10(13) mm long, 4–6 mm wide when spread; hypochile broadly elliptic to almost orbicular when expanded, 4.5–6 mm long, 2.6–3 mm deep; epichile conduplicate-concave or flat, lanceolate to lanceolate-triangular, 4–7 mm long, 2–2.5 mm wide, obtuse to acute, bending angle 10–180°. **Col-**

umn 2.5–4 mm long, 1.5–1.8 mm thick, flanked by dolabriform wings for $\frac{2}{3}$ its length, anterior wing margins projected forward; anther 2 mm long, with a pair of retrorse teeth.

Cloud forests mostly at 1200–2000 m. Flowering mostly December to July. Costa Rica to Ecuador.

In Costa Rica, *C. lehmannii* can be easily distinguished from *C. calcaratum* by the inflorescences with (5)6–12 internodes as opposed to 3–4(5) internodes in the latter species. It has smaller flowers than *C. latifolium*.

Cryptocentrum standleyi Ames, Sched. Orch. 9: 55–56. 1925. TYPE: Costa Rica, San José, La Palma, ca. 1600 m, 3 Feb. 1924, P. C. Standley 33028 (holotype: AMES). *Cryptocentrum longiscapum* Brieger, Bot. Jahrb. Syst. 97:568. 1977. TYPE: Colombia, Coteje on Río Timbiqui, 200–500 m, *Lehmann 8961* (holotype, κ). *Cryptocentrum brenesii* Schltr., nom. Figure 1A.

Plant an epiphytic herb, erect or ascendent, monopodial, branching with age, (2)4–10(20) cm tall. Stems basally enveloped by decurrent roots; apical $\frac{1}{2}$ polystichous with many leaves. **Leaves** often recurved, linear or linear-obovate to narrowly obovate (small leaves), hemicylindric to triquetrous in cross section, obscurely keeled below especially apically, (10)15–25(30) mm long, apex obtuse, mucronulate, margins erose. **Inflorescences** appearing simultaneously from the lower- or midstem internodes, erect but peduncle frequently curving, with 3–4 internodes, (2.5)3.5–6(7.5) mm long; ovary with pedicel subterete, whitish or pinkish, or tinged with red-maroon, (14)18–22 mm long, subtended by a floral bract 5–9 mm long. **Flowers** yellow-green or yellow-orange, often heavily tinged with several shades of maroon, or entirely maroon to dull wine red, subcampanulate or with perianth segments spreading to an angle of 45–90°. **Sepals** subfleshy, oblong to oblong-lanceolate, subapically mucronulate, convex, often with revolute margins; dorsal 6.5–8 mm long, 1.5–2 mm wide, obtuse to obtusely acute; lateral sepals 7–10 mm long, 1.8–2 mm wide, acute; tube broadly obconic, dorsally convex, ventrally convex, broadly 3-keeled, 1–1.3 mm long, ca. 2 mm thick; sepaline spur cylindric, broadly and obscurely clavate, straight or curved, (15)16–19 mm long. **Petals** narrowly elliptic, 7.5–8 mm long, 2.1–2.2 mm wide; basal section concave and projecting well beyond the sepaline tube; bent portion fleshier than the basal portion, bending angle 35–45°, 3.2–4.2 mm long, 1.8–2 mm wide at base. **Lip** sigmoid in profile, 6–6.5 mm long, 2–2.5 mm wide when expanded; hypochile deeply saccate, when expanded broadly elliptic, 1.5–2 mm long, 1.2–1.5 mm deep; margins entire; epichile narrowly triangular-lanceolate, straight or slightly down-flexed, bending angle 0–45°, 3–4 mm long, 1.2–1.5 mm wide at base, acuminate. **Column** 2–2.5 mm long, 1.8–2 mm thick, ventrally flanked by dolabriform wings for $\frac{2}{3}$ its length; anther 0.8–1 mm long and tall, ventrally with an obscure pair of teeth; pollinia irregularly ellipsoid, supported on an oblong stipe and amorphous viscidium.

Cryptocentrum standleyi grows both on twigs and on larger branches over a range of light exposures in rain and cloud forests from 200–2050 m. Sporadically continuously blooming, but mostly from June through December during the rainy season. Costa Rica to Ecuador.

This species and *C. flavum* are similarly small species but difficult to distinguish from one another. *Cryptocentrum standleyi* usually has longer inflorescences and longer spurs and has shorter and thinner leaves.

Maxillaria Ruiz & Pavón

(J. T. Atwood)

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1996. K. Senghas, Subtribus: Maxillariinae. In R. Schlechter. Die Orchideen 29:1727–1803. 1994.

Epiphytic **herb** caespitose or rhizomatous, sometimes caespitose as juveniles but rhizomatous at maturity; rhizomes often aerial, with short to elongate, often branching stems, with or without apically 1–4-leaved pseudobulbs. **Pseudobulbs** always terminating the shoot when present, less often absent, and forming indeterminate shoots. **Leaves** conduplicate, usually ligulate and coriaceous, rarely fleshy. **Inflorescences** 1–many, apparently reduced to 1–several elongate 1-flowered peduncles per bract (rhizome scale) at the pseudobulb base; ovary usually without pedicel. Flowers campanulate to spreading, of various colors, sometimes sweetly or offensively odoriferous. **Sepals** subequal, the lateral sepals somewhat adnate to the column foot and forming a chin at the base, rarely connate. **Petals** similar to the sepals but usually smaller, the lip concave, 3-lobate or entire, the disk usually with a fleshy or mealy, less often oily or waxy callus. **Column** semiterete, rarely winged, and usually with a conspicuous foot; pollinia 4, waxy.

A Neotropical genus of at least 450 species; 107 species in Costa Rica. The genus is best recognized by the combination of conduplicate leaves, apparently one-flowered scapose inflorescences, the presence of a column foot, four pollinia supported on a short to long stipe, and a distinct, usually horseshoe-shaped viscidium.

The relationships of *Maxillaria* are not clear. We suggest that certain Brazilian species of *Maxillaria* (e.g., *M. picta* Hook.) are more closely related to *Trigonidium* than to other species of *Maxillaria*. Also, *Mormolyca ringens* (Lindl.) Schltr. exhibits rugose leaves with raised veins, pedicellate ovaries, and a lip shape similar to that of the *Maxillaria rufescens* Lindl. complex. One species in the Costa Rican flora, *Maxillaria tigrina* C. Schweinf., has the vegetative and floral aspect of the otherwise South American genus, *Chrysocycnis*, but the pollinia are odd for that genus. Clearly, much needs to be done to improve generic realignment in the Maxillariinae.

Keys to the Species of Maxillaria

- 1a. Plants always with elongate stems that lack pseudobulbs; pseudobulbs if present restricted to base of plant (e.g., Figs. 2B–5D). 2
 - 2a. Leaf blades ≥ 30 cm, < 1 cm wide; plant pendent *M. lueri*
 - 2b. Blades if 30 cm long then much wider; plant various 3
 - 3a. Leaf axils never with > 1 scape 4
 - 4a. Sepals > 1.6 cm long, at least some leaves > 1.5 cm wide 5
 - 5a. Sepals < 2 cm long *M. alfaroi*
 - 5b. Sepals > 2.5 cm long *M. inaudita*
 - 4b. Sepals < 1.5 cm long; leaves < 1.3 cm wide 6

- 6a. Lip spatulate, midlobe > 2 times wider than isthmus *M. valerioi*
- 6b. Lip not as above 7
 - 7a. Ovary > 2.5 cm long *M. linearifolia*
 - 7b. Ovary < 1.5 cm long 8
 - 8a. Leaves elliptic, thin; plants pendent *M. appendiculoides*
 - 8b. Leaves lanceolate, chartaceous; plants usually stiffly erect
M. dendrobioides
- 3b. At least some leaf axils with > 1 scape 9
 - 9a. Column (excluding anther) \leq 4 mm long 10
 - 10a. Ratio: foot length/column length < 0.2 11
 - 11a. Leaves > 3 cm wide *M. trilobata*
 - 11b. Leaves < 2 cm wide 12
 - 12a. Leaves acute; column about 2 mm long *M. adendrobium*
 - 12b. Leaves obtuse and unequally 2-lobate; column about 4 mm long
M. nicaraguensis
 - 10b. Ratio: foot length/column length \geq 0.2 13
 - 13a. Sepals > 1.1 cm long 14
 - 14a. Lip forming a sharp angle with column foot and usually readily
movable 15
 - 14b. Lip continuous with column foot, more or less rigid, not forming
a sharp angle 17
 - 14a. Lip with simple callus at base lacking adornments
M. biolleyi
 - 14b. Lip with keels, papillae, or warts at base in addition to
fleshy callus 18
 - 18a. Tepals greenish, reddish, or brownish *M. tonduzii*
 - 18b. Tepals lavender to white 19
 - 19a. Lip subsaccate, ovary \leq 11 mm long
M. adolphii
 - 19b. Lip not saccate, ovary > 11 mm long
M. quadrata
 - 13b. Sepals < 1 cm long 20
 - 20a. Lip with a pair of rounded lobes at base *M. conduplicata*
 - 20b. Lip lacking side lobes 21
 - 21a. Flowers blood red and yellow *M. fulgens*
 - 21b. Flowers mauve to whitish or lavender *M. pittieri*
- 9b. The same \geq 4.5 mm long 22
 - 22a. Ratio: foot length/column (less anther) length > 0.3; stem branches some-
what swollen at ends 23
 - 23a. Ratio: midlobe (suborbicular)/lip \leq $\frac{1}{4}$ *M. exaltata*
 - 23b. Ratio: midlobe (lance-ovate)/lip \geq $\frac{1}{3}$ *M. meridensis*
 - 22b. Ratio: foot length/column (less anther) length \leq 0.25, stem branches never
swollen at apex 24
 - 24a. Column \geq 7 mm long 25
 - 25a. Column (without anther) 7.5–8 mm long *M. falcata*
 - 25b. Column 9–10 mm long (without anther), lip keeled on callus. . .
M. amabilis

25c. Column 13–15 mm long (without anther), lip not keeled (very shortly so in plants from Panama)	<i>M. monteверdensis</i>
24b. Column < 6 mm long	26
26a. Leaves < 1.5 cm wide	<i>M. nicaraguensis</i>
26b. Leaves > 3.5 cm wide	<i>M. trilobata</i>
1b. Plants various but elongate stems (if present) with pseudobulbs	27
27a. Plants with apically \geq 2-foliate pseudobulbs	28
28a. Plants with upright, decumbent or pendent, aerial canes	29
29a. Largest leaves 6 cm long; sepals < 12 mm long	30
30a. Flowers dark purple	<i>M. ponerantha</i>
30b. Flowers greenish to white, lip with red stain	<i>M. acervata</i>
29b. Largest leaves > 10 cm long; sepals > 12 mm long	31
31a. Flowers red to orange	<i>M. elatior</i>
31b. Flowers white to yellow	32
32a. Sepals and petals long-attenuate, \leq 4 mm wide	<i>M. ctenostachya</i>
32b. Sepals and petals oblong-elliptic, > 5 mm wide	<i>M. camaridii</i>
28b. Plants often creeping, but never with aerial canes	33
33a. Column 9–11 mm long	<i>M. friedrichsthali</i>
33b. Column 12–14 mm long	<i>M. scorpioidea</i>
33c. Column > 1.5 cm long	<i>M. aciantha</i>
27b. Pseudobulbs apically 1-foliate or pseudobulbs lacking altogether	34
34a. Plants with distinct rhizomes or canes separating pseudobulbs; usually some rhizomes aerial	Key 1
34b. Plants distinctly caespitose, lacking elongate rhizomes or canes	Key 2

Key 1: Rhizomes or Canes with Pseudobulbs, Some Aerial

1a. Lateral sepals partially united beyond column foot (e.g., Figs. 9B–10B)	2
2a. Leaves distinctly elliptic and obtuse; inflorescences usually forming all along most recently matured rhizome, not just at pseudobulb base	<i>M. brevilibia</i>
2b. Leaves lanceolate or linear, always acute; inflorescences fasciculate only at pseudobulb base	3
3a. Lateral lobes of lip suborbicular when viewed from the side	<i>M. concavilabia</i>
3b. Lateral lobes otherwise; subquadrate, elliptic or nearly absent	4
4a. Lateral lobes of lip reduced to auricles at base of midlobe, base forming a distinct claw	5
5a. Flowers orange to red; column foot longer than column	<i>M. horichii</i>
5b. Flowers white or off-white, lip with yellow midlobe; column foot equal to or shorter than column	<i>M. parviflora</i>
4b. Lateral lobes of lip conspicuous and extending to column foot, base not forming a distinct claw	6
6a. Lip when spread 3–4 mm across; flowers always white, lip white with yellow midlobe; habitat below 1200 m	<i>M. neglecta</i>
6b. Lip when spread (4.5) 5–7 mm across; flowers various colors; habitat above 900 m	<i>M. pseudoneglecta</i>
1b. Lateral sepals not united beyond column foot	7
7a. Elongate stem apex somewhat swollen, but rarely forming a distinct pseudobulb, which, if present, is concealed by leaf sheaths	8
8a. Sepals and petals > 1.5 cm	9
9a. Ratio: midlobe (suborbicular)/lip \leq $\frac{1}{4}$	<i>M. exaltata</i>
9b. Ratio: midlobe (lance-ovate)/lip \geq $\frac{1}{3}$	<i>M. meridensis</i>
8b. Sepals < 1.1 cm long	10

- 10a. Lip with pair of rounded lobes at base *M. conduplicata*
- 10b. Lip lacking side lobes 11
- 11a. Flowers blood red and yellow *M. fulgens*
- 11b. Flowers mauve to whitish or lavender *M. pittieri*
- 7b. Stem apex clearly modified into pseudobulb (*M. schistotele*, known only from type photos and original description, cannot be taken further) 12
- 12a. Sheaths subtending pseudobulbs lacking blades or articulations 13
- 13a. Pseudobulbs < 1.4 cm long; column foot about as long as column; leaves subterete *M. uncata*
- 13b. Pseudobulbs > 1.5 cm long; foot much shorter than column; leaves never subterete 14
- 14a. Sepals > 1.7 cm long 15
- 15a. Leaves < 9 mm wide; flowers basically red, the lip simple, not at all 3-lobate 16
- 16a. Lip apex white spotted with reddish maroon *M. tenuifolia*
- 16b. Lip apex whitish, suffused with red or rose *M. sanguinea*
- 15b. Leaves \geq 1 cm wide; flowers yellow or striped, not red, lip clearly 3-lobate 17
- 17a. Flowers yellow; sepals \geq 3 cm long *M. planicola*
- 17b. Flowers translucent, striped with maroon; sepals < 2.9 cm long *M. tigrina*
- 14b. Sepals < 1.5 cm long 18
- 18a. Sepals < 8 mm long *M. caespitifica*
- 18b. Sepals > 8 mm long 19
- 19a. Flowers orange-yellow with red on lip *M. variabilis*
- 19b. Flowers green stained with red, especially lip .. *M. costaricensis*
- 12b. Sheath(s) at base of pseudobulb foliaceous or at least with articulation 20
- 20a. Column without anther \geq 1.7 cm long *M. haberi*
- 20b. Column without anther < 1.7 cm long 21
- 21a. Petiole of foliaceous bracts abruptly narrowed above articulation and/or leaf < 2 mm wide 22
- 22a. Leaf apex rounded to emarginate; neither acute nor acuminate, or if otherwise leaf < 2 mm wide (see Figs. 12A–13B) 23
- 23a. Leaves terete, < 2 mm in diameter *M. muscoides*
- 23b. Leaves not terete, > 2 mm wide 24
- 24a. Midlobe > $\frac{1}{3}$ length of lip 25
- 25a. Pseudobulbs elongate, \geq 2 times longer than wide 26
- 26a. Pseudobulbs distinctly grooved or fluted; ratio: lip length/sepal length < $\frac{3}{5}$ *M. flava*
- 26b. Pseudobulbs not grooved; ratio: lip length/sepal length > $\frac{3}{5}$ 27
- 27a. Sepals > 1.1 cm long *M. lankesteri*
- 27b. Sepals < 1 cm long *M. wercklei*
- 25b. Pseudobulbs < 2 times longer than wide *M. burgeri*
- 24b. Midlobe < $\frac{1}{3}$ length of lip *M. microphyton*
- 22b. Leaf apex acute to acuminate, rarely obtuse and shortly acuminate... 28
- 28a. Column foot \geq $\frac{1}{2}$ column length less anther, clearly differentiated from base of lip *M. tubercularis*
- 28b. Column foot < $\frac{1}{2}$ column length, often poorly differentiated from base of lip 29

- 29a. Column less anther > 6 mm long 30
 - 30a. Column less anther < 11 mm long .. *M. sigmoidea*
 - 30b. Column less anther > 13 mm long ... *M. vaginalis*
- 29b. Column less anther < 6 mm long 31
 - 31a. Column less anther < 2 mm long *M. minor*
 - 31b. Column less anther > 2.5 mm long 32
 - 32a. Flowers purple to reddish *M. paleata*
 - 32b. Flowers pink, lavender, white, or yellowish .. 33
 - 33a. Lower quarter of lip subsaccate; midlobe < ½ lip; flowers light lavender to white
..... *M. schlechteriana*
 - 33b. Lower quarter of lip not at all saccate; midlobe > ½ lip; flowers yellowish to pinkish
..... *M. dichotoma*
- 21b. Petiole not abruptly narrowed above articulation; leaves ≥ 2 mm wide .. 34
 - 34a. Blades of rhizome sheaths subtending flowers appearing half-lyre-shaped from side (e.g., Figs. 14D–15B) 35
 - 35a. Sepals and petals pure white 36
 - 36a. All leaves ≤ 1.8 cm wide *M. camaridii*
 - 36b. Some, if not all, leaves ≥ 1.8 cm wide ... *M. ampliflora*
 - 35b. Sepals and petals otherwise 37
 - 37a. Column < 6 mm long *M. umbratilis*
 - 37b. Column > 6 mm long 38
 - 38a. Lip when spread wider than long 39
 - 39a. Sepals > 3.4 cm long *M. ampliflora*
 - 39b. Sepals < 3.3 cm long *M. bradeorum*
 - 38b. Lip when spread narrower than long
..... *M. campanulata*
 - 34b. Sheaths various but not appearing half-lyre-shaped from side 40
 - 40a. Sepals ≥ 1.7 cm long 41
 - 41a. Leaves ≤ 1 cm wide *M. oreocharis*
 - 41b. Leaves ≥ 1.1 cm wide, or if narrower then obtuse ... 42
 - 42a. Plant with distinctly foliaceous bracts subtending pseudobulb 43
 - 43a. Columns less anther < 6 mm long 44
 - 44a. Ovary trigonous; fruit 3-alate
..... *M. gomeziana*
 - 44b. Ovary terete, fruit not 3-alate
..... *M. bracteata*
 - 43b. Column less anther > 6 mm long 45
 - 45a. Midlobe of lip suborbicular, serrulate
..... *M. serrulata*
 - 45b. Midlobe of lip otherwise 46
 - 46a. Flowers white with yellow lip .. 47
 - 47a. Leaves < 2 cm wide
..... *M. camaridii*
 - 47b. Leaves > 2.5 cm wide
..... *M. suaveolens*
 - 46b. Flowers orange to red or purple .. 48
 - 48a. Ovary with pedicel > 3 cm long
..... *M. elatior*
 - 48b. Ovary with pedicel < 2 cm long
..... *M. tubercularis*
 - 42b. Bract at base of pseudobulb usually with articulation

	but rarely with a distinct broadened blade; lip not serrulate	49
	49a. Flowers clearly white with yellow on lip	
	<i>M. alba</i>
	49b. Flowers green, whitish, or yellowish	
	<i>M. anceps</i>
40b.	Sepals < 1.6 cm long	50
50a.	Youngest rhizome concealed by several foliaceous sheaths with fully developed blades	51
51a.	Flowers dark purple	<i>M. ponerantha</i>
51b.	Flowers light green with red stain on lip	
	<i>M. acervata</i>
50a.	Youngest rhizome concealed by 0–3 blade-bearing sheaths, rest non-blade-bearing	52
52a.	Leaves never obtuse and deeply emarginate, larger > 7 cm long	53
53a.	Flowers red with yellow lip	<i>M. fulgens</i>
53b.	Flowers otherwise	54
54a.	Leaves > 1.2 cm wide, scapes appearing precociously on new shoots	<i>M. diuturna</i>
54b.	Leaves < 1.1 cm wide, scapes appearing at base of mature shoots	<i>M. oreocharis</i>
52b.	Leaves obtuse and deeply emarginate, < 6 cm long, elliptic	55
55a.	Sepals > 11 mm long	<i>M. lankesteri</i>
55b.	Sepals < 9 mm long	<i>M. wercklei</i>

Key 2: No Conspicuous Rhizomes or Canes

- 1a. Shoots with ≥ 3 leaves arranged in fan, or if pseudobulbs present, always with ≥ 3 subtending, foliaceous sheaths, leaves never broadly elliptic with petiole ≤ 3 mm broad (see Figs. 17B–18D) 2
- 2a. Plants with conspicuous pseudobulbs 3
 - 3a. Sepals < 2.2 cm long *M. crassifolia*
 - 3b. Sepals 2.3–2.6 cm long *M. maleolens*
 - 3c. Sepals > 3 cm long *M. nasuta*
- 2b. Plants lacking pseudobulbs, or these hidden by foliaceous sheaths 4
 - 4a. Plant pendent, psymoid, handlike; leaves equitant, iris-like *M. valenzuelana*
 - 4b. Plant and leaf otherwise 5
 - 5a. Column foot longer than column *M. angustissima*
 - 5b. Column foot shorter than column 6
 - 6a. Leaves not abruptly narrowed above the articulation, thick, obtuse *M. crassifolia*
 - 6b. Leaves abruptly narrowed above articulation, thin, distinctly acute 7
 - 7a. Leaves ≤ 1.3 cm wide with unspotted sheaths, flowers wine red *M. bicallosa*
 - 7b. Leaves > 1.7 cm wide with spotted sheaths, flowers yellow *M. chartacifolia*
- 1b. Shoots always with pseudobulbs, rarely with 3 foliaceous sheaths at base 8
 - 8a. No broadened, foliaceous sheaths subtending pseudobulbs, although articulations sometimes present (rarely in *M. alba* or *M. oreocharis*) 9
 - 9a. Scape included within subtending rhizome bract 10

10a. Flowers pure white with yellow on lip	<i>M. alba</i>
10b. Flowers otherwise	11
11a. Sepals ≥ 1.8 cm long	12
12a. Leaf < 4 mm wide, linear, not petiolate	<i>M. sanguinea</i>
12b. Leaf > 1 cm wide, elliptic, long-petiolate	<i>M. longipetiolata</i>
11b. Sepals < 1.8 cm long	13
13a. Sepals < 8 mm long	<i>M. caespitifica</i>
13b. Sepals > 8 mm long	14
14a. Flowers orange-yellow with red on lip	<i>M. variabilis</i>
14b. Flowers green stained with red, especially lip ..	<i>M. costaricensis</i>
9b. Scape exerted beyond subtending rhizome bract	15
15a. Leaves < 1.1 cm wide	16
16a. Sepals partially united beyond column foot	<i>M. strumata</i>
16b. Sepals not so united	17
17a. Leaves < 12 cm long	<i>M. piestopus</i>
17b. Leaves > 12 cm long	18
18a. Flowers with spreading sepals, column > 1 cm long	<i>M. sanguinea</i>
18b. Flowers campanulate; column < 1 cm long	<i>M. oreocharis</i>
15b. Leaves ≥ 1.1 cm wide	19
19a. Petals lanceolate, distinctly broadest on the lower $\frac{1}{4}$	20
20a. Midlobe of lip fleshy, black, reflexed, and forming an angle of about 90° with base	<i>M. longiloba</i>
20b. Midlobe yellow and white, often with purple spots, neither black, nor so reflexed	21
21a. Flowers ≥ 2 per rhizome bract; lip < 1.6 cm long	<i>M. ringens</i>
21b. Flowers 1(–2?) per rhizome bract; lip > 2 cm long	22
22a. Pseudobulbs usually truncate apically; sepals ≥ 5.5 cm long	<i>M. endresii</i>
22b. Pseudobulbs usually conic, not truncate; sepals ≤ 5 cm long	<i>M. angustisegmenta</i>
19b. Petals various, but not broadest on lower $\frac{1}{4}$	23
23a. Midlobe of lip $\leq \frac{1}{3}$ as long as lip	24
24a. Lip apex reflexed black, lance-ovate	<i>M. longiloba</i>
24b. Lip apex straight, sometimes with purple spots, not black ..	25
25a. Pseudobulb suborbicular, small, and hidden by subtending bracts	<i>M. cryptobulbon</i>
25b. Pseudobulb ovoid, emerging from subtending bracts.	<i>M. brunnea</i>
23b. Midlobe of lip $> \frac{1}{3}$ length of lip	26
26a. Petals distinctly spatulate or oblanceolate	<i>M. piestopus</i>
26b. Petals distinctly not spatulate or oblanceolate	27
27a. Inflorescence shorter than pseudobulb	28
28a. Petiole $\geq \frac{1}{4}$ as long as blade	<i>M. longipetiolata</i>
28b. Petiole $< \frac{1}{4}$ as long as blade	29
29a. Sepals and petals maroon to brown	<i>M. dressleriana</i>
29b. Sepals and petals cream-white to yellow ...	30
30a. Lip orange	<i>M. hedwigiae</i>
30b. Lip yellow with red stripe up center	<i>M. acutifolia</i>
30c. Lip otherwise, usually yellow with red dots or stained dark	<i>M. moralesii</i>
27b. Inflorescence longer than pseudobulb	31

- 31a. Lip orange, midlobe broadly lanceolate *M. hedwigiae*
- 31b. Lip red, purplish, or cream spotted with maroon, midlobe ovate (*cucullata* group) 32
 - 32a. Flowers with sepals and petals stained with purple; midlobe of lip with truncate to emarginate callus *M. obscura*
 - 32b. Flowers with lines of purple dots on sepals and petals, lip usually dark red or maroon *M. punctostriata*
 - 32c. Flowers with white sepals and petals, lip cream spotted with maroon *M. cedralensis*
- 8b. Pseudobulb subtended by ≥ 1 foliaceous sheath, at least when young 33
 - 33a. Sepals > 10 cm long *M. rodriguezi*
 - 33b. Sepals < 10 cm long 34
 - 34a. Foot at least as long as column less anther 35
 - 35a. Sepals < 2.7 cm long 36
 - 36a. Flowers held much higher than shoots; lip twice length of foot plus column less anther *M. attenuata*
 - 36b. Flowers much shorter than shoots; lip not much longer than foot plus column less anther 37
 - 37a. Anther bed lacerate; lateral sepals attenuate, ≥ 1.8 cm long ... *M. confusa*
 - 37b. Anther bed not at all lacerate; lateral sepals not attenuate, ≤ 1.8 cm long *M. ramonensis*
 - 35b. Sepals > 2.8 cm long 38
 - 38a. Leaves with large, white spots *M. reichenheimiana*
 - 38b. Leaves lacking such spots 39
 - 39a. Sepals ≥ 5.5 cm long *M. arachnitiflora*
 - 39b. Sepals ≤ 5 cm long *M. pachyacron*
 - 34b. Foot shorter than column 40
 - 40a. Lip subentire to indistinctly 3-lobate *M. chionantha*
 - 40b. Lip distinctly and deeply 3-lobate near the apex 41
 - 41a. Sepals ≥ 1.4 cm long 42
 - 42a. Sepals ≥ 3.5 cm long; flowers generally held higher than the shoots *M. pachyacron*
 - 42b. Sepals ≤ 3 cm long; flowers much shorter than shoots 43
 - 43a. Plants < 12 cm tall, ovary with pedicel < 1.7 cm long ... *M. brachybulbon*
 - 43b. Plants > 25 cm tall, ovary with pedicel > 2.5 cm long ... *M. cryptobulbon*
 - 41b. Sepals ≤ 1.3 cm long 44
 - 44a. Sepals < 6 mm long, column foot nearly absent *M. vittariifolia*
 - 44b. Sepals > 8 mm long, column foot nearly as long as column ... *M. acostae*

Maxillaria acervata Rchb. f., Bonplandia 3:217. 1855. TYPE: Costa Rica, "Ad Suru[n]gnes," Oersted s.n. (lectotype selected here: w; isolecotype: κ). *Maxillaria foliosa* Ames & C. Schweinf., Sched. Orch. 8:60. 1925. TYPE: Costa Rica, C. H. Lankester 478 (holotype: AMES). Figure 7D.

Plant epiphytic, somewhat straggly, especially in lower elevation specimens, to 30 cm tall, rooted only at the base; shoots ascending, 3–9 cm apart. Roots white, to 1 mm in diameter. **Pseudobulbs** 2(1)-foliate, ovoid, compressed, 1–3 cm long, about 1 cm wide, concealed when young by leaf-bearing sheaths. **Leaves** and leaf-bearing sheaths to more than 20 in developing shoots, all except the apical leaves of the pseudobulbs abscising at matu-

rity, oblong-lanceolate, 1.5–6 cm long, 5–10 mm wide, obtuse to unequally 2-lobate. **Inflorescence** 1 per sheath axil in the immature shoot; scape about 1 cm long, concealed by few acute sheaths; ovary with pedicel 1.5–2 cm long, exceeding the subtending bract. **Flowers** erect, green to white, the lip with red stain on the lower $\frac{2}{3}$. **Sepals** ovate, elliptic, obtuse, apiculate, 1 cm long, 4 mm wide. **Petals** elliptic, 9 mm long, 3.5 mm wide. **Lip** hinged to the column foot, simple, spatulate, 1 cm long, 4 mm wide; callus oblong, extended to just beyond the middle, obtuse or rounded apically. **Column** arcuate, expanded above, 7 mm long; foot 2 mm long; pollinia 4 lacking a stipe but with saddle-shaped viscidium. **Cap-sule** ellipsoid, 2 cm long.

Epiphytic in primary montane and premontane evergreen forests at 700–2000 m. Flowering September to March. Nicaragua to Panama; also reported from Ecuador as *M. foliosa*.

This species is closely related to *M. ponerantha* Rchb. f., but the plant is somewhat larger, and the flowers are light green with red on the lower half of the lip. *Maxillaria ponerantha* is a somewhat smaller, more widespread, lowland species with dark purple flowers. The pseudobulbs are nearly always apically 2-foliate in *M. acervata* and 1-foliate in Costa Rican *M. ponerantha*. Leaf-bearing rhizome bracts of immature shoots in *M. foliosa* may exceed 20. Lower elevation examples are much less compact than upper elevation conspecifics.

Authors usually treat this as the synonym *M. foliosa* (e.g., Hamer, Icon. Pl. Trop 9: Plate 854; Atwood, Icon. Pl. Trop 14: Plate 1346). Both available types of *M. acervata* agree in the rhizomatous habit, the foliaceous sheaths at the base of the pseudobulbs, and the rather simple flowers.

Maxillaria aciantha Rchb. f., Bot. Zeitung (Berlin) 10:858. 1852. TYPE: Costa Rica, *J. de Warszewicz s.n.* (not seen). *Lycaste aciantha* (Rchb. f.) Rchb. f., Bonplandia 3:216. 1855. Figure 9A.

Plant a loosely caespitose to straggly epiphyte, rarely forming large clumps, some of the shoots to 3 cm apart; often pendent with only basal shoots rooted. Roots fibrous, white, to 1 mm in diameter. **Pseudobulbs** cylindrical-fusiform, 3–8 cm tall and 0.7–1.2 cm wide, laterally flattened and with several vertical ribs conspicuous especially when dried, subtended by 1–3 early deciduous, blade-bearing bracts, apically 2–4 foliate. **Leaves** linear to elliptic-oblong, 3–15 cm long and 0.8–1.6 cm wide, unequally 2-lobed apically. **Inflorescence** lateral, 1-flowered, borne singly per rhizome bract, the peduncle about 1.5 cm long covered by 3–5 inflated bracts, with the uppermost bract subtending the flower 2.0–2.7 cm long; ovary with pedicel to 2 cm long at anthesis, usually much longer than the upper of 2 subtending bracts,

soon elongating after pollination. **Flowers** coriaceous, persistent in fruit, cartilaginous, not opening fully and difficult to spread, brick red to yellowish green with red stain on the inner surface, lip dark red. **Sepals** similar; dorsal lanceolate, acute, concave, apically carinate, 2.5–3.2 cm long, 5–6 mm wide; lateral sepals narrowly ovate, falcate, 2.5–3 cm long, 5–7 mm wide. **Petals** narrower than the sepals, falcate, 2.2–2.8 cm long. **Lip** hinged to the column foot, elliptic-oblong to narrowly rhombic, arcuate, thickened along the margin and at the apex, 2–2.6 cm long and 5–6 mm wide; callus linear from the base to just below the middle, the apical fifth appearing oily internally. **Column** cylindric about 1.7–2.2 cm long; a foot 3 mm long; pollinia 4, supported on a stipe 3 mm long; anther bed ciliate at the margin. **Cap-sule** ellipsoid, 3–4 cm long.

A locally common epiphyte of wet forests, 50 to perhaps 1000 m. Uncommon from Mexico (Campeche? and Chiapas) to Chiriquí, Panama; possibly in Colombia and Peru. Flowering mostly October to February. In Central America, *M. aciantha* is found almost exclusively in the Caribbean drainage.

This is closely related to sympatric *M. friedrichsthali*, and the two species sometimes occur on the same host tree. The shoots and flowers of *M. aciantha* are conspicuously larger, and the flower color is reddish to yellow-green, never white. It also differs from closely related *M. scorpioidea* Kraenzl, by the larger flowers with dark red, unspotted lip. That species is almost exclusively restricted to the Pacific drainage.

Maxillaria acostae Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:301. 1923. TYPE: Costa Rica, near San Ramón, *Acosta s.n.* (neotype selected here: AMES 40543). Figure 25C.

Plant a small, caespitose epiphyte rarely to 20 cm tall. Roots to 0.5 mm in diameter. **Pseudobulbs** ovoid, 1–2 cm long, subtended by nonfoliaceous, triangular sheaths transversely spotted with purple; apex 1-foliate. **Leaves** with petiole $\frac{1}{4}$ – $\frac{1}{2}$ the blade length; blade somewhat coriaceous, narrowly to broadly elliptic, 22–100 mm long, 4–17 mm wide, acute to obtuse or acuminate. **Inflorescences** 1–2 per rhizome bract axil of the mature shoot; scape 2–3 cm long, concealed by spotted, acuminate sheaths; ovary with pedicel 7–11 mm long, somewhat exceeded by the floral bract. **Flowers** white turning orange-brown, the lip with crimson callus and midlobe. **Sepals** dissimilar; dorsal lance-oblong, obtuse to acute, 1–1.2 cm long, 3–4 mm wide; lateral sepals oblique, oblong, 1.2–1.3 cm long, 3.5–4.5 mm wide, acute to obtuse. **Petals** lanceolate-elliptic to oblanceolate, 1 cm long, 2.5–3 mm wide, acute to obtuse. **Lip** hinged to the column foot, cuneate to obovate, 9–11 mm long, 3–5.5 mm wide when spread, the apical $\frac{1}{3}$ deeply 3-lobate; lateral lobes embracing the column rounded; midlobe suborbicular to ovate, somewhat recurved; callus an oblong, fleshy ligule ending about $\frac{2}{3}$ from the base. **Column** arcuate, 5–6 mm long excluding the anther; foot

2.5–3.5 mm long; anther about 2 mm long. **Capsule** ellipsoid, about 1.5 cm long.

Epiphytic at 650–1500 m. Flowering March to December. Rarely collected, perhaps because of its small size. Costa Rica and Panama.

There appear to be two kinds of *M. acostae* with identical flowers but different leaves, those with a maximum leaf width-to-length ratio of ≥ 0.14 and those with a ratio of ≤ 0.11 . Both vegetative types are known from Costa Rica and Panama, but the vertical range of the broad leaf form is 650–1000 m, while that of the narrow leaf form is 1050–1500. There may be two distinct species represented here, but the apparently identical flowers do not support this. Similar leaf width-to-length ratios taken from the type description are 0.09 and 0.10, corresponding with higher elevation forms. None of this form has been recently collected. The designated neotype is all that has been found of the original materials.

Maxillaria acutifolia Lindl., Edwards's Bot. Reg. 25: misc. 92. 1839. TYPE: Demerara, *Loddiges s.n.* (holotype: κ). Not *Maxillaria acutifolia* Schltr. Figure 21B.

Plant a caespitose epiphyte rarely forming large clumps; shoots to about 1 cm between pseudobulbs. Roots fibrous, to about 1 mm in diameter. **Pseudobulbs** 1-foliate, cylindric, to about 6 cm long and 1.5 cm in diameter. **Leaf** shortly petiolate, narrowly elliptic, to 21 cm long and 1.5 cm wide, acute. **Inflorescence** usually shorter than the pseudobulbs; ovary with pedicel 1.3–1.8 cm long. **Flower** dull yellow, the lip yellow with red spots and a red central line. **Sepals** similar, 1.2–1.5 cm long, about 4 mm wide; dorsal oblong-lanceolate, lateral sepals somewhat oblique, falcate, acute to obtuse. **Petals** elliptic, 1–1.4 cm long, 2–3 mm wide, acute. **Lip** articulated with the short column foot, 3-lobate below the middle, 1–1.2 cm long; lateral lobes acute; midlobe more or less oblong, truncate, and retuse. **Column** arcuate, clavate, 7 mm long, with a short foot about 2 mm long.

Tropical forests at 0–1350 m. Flowering December to February. Local from Honduras to Ecuador and at least northern South America.

This is one of the two smaller flowered species of the *M. rufescens* complex in Costa Rica, the other being *M. dressleri*, with wine red to maroon flowers. *Maxillaria acutifolia* differs most strikingly in the more or less cylindric, not ovoid pseudobulb and relatively narrow leaf. In live material the red line up the center of the lip is the most distinctive floral feature of the species. *Maxillaria hedwigiae* is a larger plant with proportionately broader pseudo-

bulbs. Plants accepted here as *M. acutifolia* have a somewhat more cuneate midlobe than the type and may prove to be the same as *M. moralesii*, in which case the latter name should be used.

Maxillaria adendrobium (Rchb. f.) Dressler, Taxon 13:248. 1964. *Ponera adendrobium* Rchb. f., Flora 48:278. 1865. TYPE: Cuba, Wright 1697 (isotypes: AMES 6081, 6082) *Pleuranthium adendrobium* (Rchb. f.) Benth. & Hook. f., J. Linn. Soc. 18:312. 1881. *Neourbania adendrobium* (Rchb. f.) Fawc. & Rendle, J. Bot. 47:125. 1909. Figure 4A.

Plant sometimes more than 1 m tall lacking pseudobulbs; stems somewhat fractiflex, pendent, apparently monopodial, mostly concealed by leaf sheaths. Roots appearing along the entire stem to 2.5 mm in diameter. **Leaves** coriaceous, narrowly elliptic, articulate to the sheaths, usually deciduous below, 5.5–11 cm long, 7–15 mm wide, acute. **Inflorescences** 1–few per leaf axil, not much exerted beyond the subtending sheath; ovary with pedicel about 10 mm long, subtended by a shorter, triangular bract. **Flowers** pale green to yellow, purplish toward the base; column dark. **Sepals** subequal, narrowly ovate, 5.5–7 mm long, about 2 mm wide, acute. **Petals** narrowly ovate, 5 mm long, 2 mm wide, acute. **Lip** attached to the column foot, 3-lobate, about 5 mm long; lateral lobes short, ovate; midlobe large, ovate-elliptic, retuse, conspicuously mucronate abaxially near the apex; margins somewhat crenate; callus globose at the base of the midlobe. **Column** stout, about 2 mm long; foot at approximately a right angle with the column, about 2 mm long. **Capsule** ellipsoid, about 1.3 cm long.

Epiphytic mostly in rain forests at 350–850 m. Flowering September to November. Costa Rica, Panama, Jamaica, and Cuba; doubtfully reported from Ecuador on the basis of a similar plant with a different lip.

Maxillaria adolphii Ames & Correll, Bot. Mus. Leaflet 11:18. 1943. *Camaridium adolphii* Schltr. (invalidly published), Repert. Spec. Nov. Regni Veg. Beih. 19:58. 1923. *Ornithidium tonduzii* Schltr., Repert. Spec. Nov. Regni Veg. 3:250–251. 1907. TYPE: Costa Rica, on the banks of the Rio Angel (Poas), *Tonduz 10770* (lectotype selected here: US 938677; isoelectotype: US 577310; drawing of type: AMES). Not *Maxillaria tonduzii* (Schltr.) Ames & Correll. 1943. Not *Camaridium tonduzii* Schltr. 1910. Figure 5C.

Plant a large, cane-forming, apparently monopodial epiphyte or terrestrial to 2 m tall, often becoming pendent with size; juveniles caespitose, sympodial with each shoot terminating in a pseudobulb. Mature stems sheathed with closely spaced, conduplicate leaves, most-

ly deciduous near the base with sheaths fragmenting into fibers. Roots slender, to about 1 mm in diameter. **Pseudobulbs** of juveniles to about 10 cm long, subtended by 1 or more foliaceous sheaths, the apex 1(–2?)-foliate. **Leaves** articulate, coriaceous, keeled beneath, shortly petiolate above the articulation; blades 5–20 cm long, 1.2–2.8 cm wide; apex unequally 2-lobate. **Inflorescences** several to many per leaf axil; scapes to nearly 10 cm long but not much exerted beyond the subtending leaf blade, clothed in acute sheaths; ovary with pedicel 8.5–11 mm long, usually exceeded by the subtending floral bract. **Flowers** fragrant, with somewhat recurved segments, pinkish lavender to white, the lip purple. **Sepals** similar, oblong-oblancoate, 1.4–1.9 cm long, 4–5 mm wide, the apex acute and externally keeled; **petals** elliptic-oblancoate, 1.2–1.4 cm long, 4–5 mm wide, the apex acute. **Lip** rigid with the column foot, subsaccate on the lower half, 3-lobate above the middle, 4–7 mm long, 2.5–4 mm wide in natural position; lateral lobes little extended beyond the sinuses, rounded; mid-lobe ovate, rounded to emarginate, recurved; callus a truncate ligule ending just below the lobe sinuses with an additional 3 or more papillae at the base. **Column** stout, 3–4 mm long excluding the anther, the anther about 1.5 mm in diameter. **Capsules** ellipsoid, about 1 cm long.

Epiphytic or terrestrial fully exposed in windy, cold cloud forests at 2200–3300 m. Flowering November to August. Endemic to Costa Rica and western Panama.

Maxillaria adolphii is distinguished from closely related *M. biolleyi* (Schltr.) L. O. Williams by the more saccate lip with relatively complex callus that is papillose at the base and by a pair of lateral lobes distally. *Maxillaria biolleyi* has orange in the lip, a much more simple callus lacking papillae, and a pair of lateral lobes at the base. Available herbarium specimens with flowers intermediate with *M. biolleyi* suggest that natural hybrids may occur. Similar *Maxillaria quadrata* with nonsaccate lip may prove to be a variant of *M. adolphii*.

The nomenclature of *M. adolphii* was confused when Schlechter indicated that *Ornithidium tonduzii* Schltr. “might” (*möge*) be called *C. adolphii* Schltr. in the future but did not accept the new name at the time of publication, thus rendering it invalidly published. Although Ames and Correll published the combination as *M. adolphii*, it must be accepted as a new name. The lectotype is the more complete of two isotypes that surfaced at US and is provided with floral analysis.

Maxillaria alba (Hook. f.) Lindl., Gen. & Sp. Orch. Pl. 143. 1832. *Dendrobium album* Hook. f., Exot. Fl. t. 142. 1825. TYPE: Jamaica (holotype: K). *Broughtonia alba* (Hook. f.) Spreng.,

Syst. Veg. 3:735. 1826. *Camaridium album* (Hook. f.) Hoehne, Arq. Bot. Est. São Paulo 2(4):72. 1947. ?*Maxillaria hedyosma* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 42:131. 1925. Figure 15D.

Plant epiphytic with ascending rhizomes, each terminated in a pseudobulb and rooted only at the base; successive shoots 1.5–6 cm apart. Roots white, to 1.5 mm in diameter. **Pseudobulbs** ancipitous, ovate, smooth, 2.5–6 cm long, 1–2.5 cm broad, 1-foliate; articulation usually oblique, subtended by sheaths often with soon deciduous blades. **Leaves** shortly petiolate, subcoriaceous, linear to narrowly elliptic, 20–40 cm long, 1.4–2.5 cm wide, tapering to an obtuse apex. **Inflorescences** 1 in each of several rhizome bract axils of the developing shoot; scapes 2–3 cm long, hidden by the subtending rhizome bract; ovary with pedicel 2.5–3.5 long, much exceeding the attenuate floral bract. **Flowers** fragrant, white, the lip creamy white with yellow apex. **Sepals** lanceolate, acuminate, 2.2–2.5 cm long, 5–7 mm wide. **Petals** obliquely lanceolate, 1.8–2.2 cm long, 5–6 mm wide, acute. **Lip** articulated to the column foot, ovate, puberulent, lightly 3-lobate on the apical 1/3, 1.3–1.6 cm long, 4–6 mm wide; callus extending to just beyond the middle, parabolic in front. **Column** arcuate, about 1 cm long; foot 3 mm long. **Capsule** ellipsoid.

Large crown epiphyte of wet forests at 250–1200 m. Flowering throughout the year. Guatemala to Panama, Jamaica, Cuba, and much of tropical South America.

This is most similar to *M. anceps* Ames & C. Schweinf. and *M. nagelii* L. O. Williams (not in Costa Rica), both of higher elevations, with decidedly greenish flowers and more conspicuous callus. It also resembles *M. oreocharis* Schltr., a species with smaller, reddish-stained flowers that form at the base of mature shoots.

Maxillaria alfaroi Ames & C. Schweinf., Sched. Orch. 10:83–84. 1930. TYPE: Costa Rica, Carretera Fuentes, *Alfaro* 284 (holotype: AMES). Figure 2B.

Plant stout, with erect stems perhaps 50 or more cm tall, apparently lacking pseudobulbs; stems erect, concealed by the distichous, imbricate, conduplicate leaf sheaths. Roots large, 2.5 mm in diameter. **Leaves** linear-oblong to narrowly elliptic, to 23 cm long, 2.5 cm wide, becoming smaller toward the stem apex, the midvein sulcate above and carinate below; blade articulate to the sheath base; apex rather abruptly narrowed, obtuse or rounded. **Inflorescence** single per leaf axil, the scape to about 8 cm long and concealed by several acute sheaths. **Flowers** orange-yellow. **Sepals** dissimilar; dorsal concave, oblong-ovate, about 1.9 cm long, 8–9 mm wide, acute and mucronate; lateral sepals somewhat oblique, broadly lanceolate, 1.9 cm long, about 7 mm wide, acute and mucronate. **Petals** ovate-oblong, 1.6 cm long, 6.5–

7 mm wide, acute, somewhat oblique. **Lip** simple, subquadrate-oblong, slightly constricted in the middle, about 1.4 cm long, 6.5 mm wide; apex broadly rounded and somewhat retuse. **Column** stout, strongly arcuate, 7–8.5 mm long. **Capsule** apparently narrowly ellipsoid.

Maxillaria alfaroi is represented here only by the type collection and by a photograph of a single plant in a live collection in British Columbia. The above description is condensed from the original and augmented from a photograph of the single live plant. Little is known of its ecology except that the type was collected at 1400 m and in flower in August. It appears to be related to, if not identical with, *M. densifolia* (Poeppig & Endl.) Rchb. f. from South America. It should be easily recognized by the relatively large canes lacking pseudobulbs and the rather simple flower with simple lip.

Maxillaria amabilis J. T. Atwood, Lindleyana 9: 239–241. 1994. TYPE: Costa Rica: Province of Alajuela: Zona Protectora, Chayote, Llano Bonito, Naranjo, 1200 m, *L. D. Gomez, G. Herrera, & W. Murillo* 23979 (holotype: MO; isotypes: F, SEL). Figure 7B.

Plant a large, erect, cane-forming epiphyte to at least 90 cm tall; canes of mature shoots lacking pseudobulbs, concealed by rugose leaf sheaths, mostly leafless on the lower canes. Roots mostly restricted to the base, to about 1.5 mm in diameter. **Pseudobulbs** present only at base (as caespitose juveniles), about 5 cm tall and 2.5 cm wide, compressed, sessile, subtended by 1–2 foliaceous sheaths, apically 1-foliate with shortly petiolate leaf. **Leaves** thin, articulate; blade keeled below, 4–7 cm long, 1.3–2.8 cm wide, the apex obtuse to rounded and unequally 2-lobate. **Inflorescences** several per leaf axil, long for the genus and sometimes exceeding the subtending leaf; scapes to about 9 cm long; ovary with pedicel 9–11 mm long, subtended by a subequal to longer subulate, acute floral bract. **Flowers** large for the genus, campanulate, to about 2.5 cm long, white to lavender, or the outer surfaces of sepals and petals with pink stripe, lip yellow or orange. **Sepals** similar, oblong-elliptic, 2.2–2.5 cm long, 4.5–6 mm wide, the apex acute and carinate externally. **Petals** oblanceolate, about 2.2 cm long, 5.5–6.5 mm wide, acute to acuminate. **Lip** loosely rigid with the column foot, canaliculate on the lower half, 3-lobate on the upper half, about 9 mm long and 3 mm wide in natural position, 1.2 cm long when spread; lateral lobes embracing the column; midlobe ovate, obtuse; callus a truncate lamina terminating at about the lobe sinuses with a keel on the lower ½ elevated and acute in front. **Column** nearly straight, cylindrical, 9 mm long excluding foot and anther; foot short, about 2 mm long; anther about 1.5 mm in diameter.

Maxillaria amabilis is a poorly known epiphyte apparently of premontane and montane rain for-

ests at 1200–1900 m. Flowering at least in October and January. Endemic to Costa Rica.

Maxillaria ampliflora C. Schweinf., Bot. Mus. Leaf. 8:188. 1940. *Camaridium grandiflorum* Ames, Proc. Biol. Soc. Wash. 34:149–150. 1921. TYPE: Panama, Chiriquí, east of the Rio Caldera, *Killip* 3565 (holotype: AMES; isotype: US). Not *Camaridium grandiflorum* Schltr. Not *Maxillaria grandiflora* Lindl. Figure 14E.

Plant a straggly terrestrial or epiphyte forming erect to decumbent canes to about 2 m long; stems comprised of successively borne shoots, each terminated by a pseudobulb. Roots forming only on the lowest shoots, to 2.5 mm in diameter. **Pseudobulbs** ovoid, compressed, to about 5 cm long; base subtended by several leaves; apex 1-foliate. **Leaves** distinctly and shortly petiolate, conduplicate; blade narrowly elliptic, increasing in size toward apex within each shoot, to about 30 cm long, 4 cm wide, acute. **Inflorescence** 1(2) per bract axil, subtended by a foliaceous bract with distinct articulation; scapes sheathed in acute bracts, to about 7 cm long; ovary with pedicel 1.3–1.6 cm long, exceeded by the subtending floral bract. **Flowers** somewhat campanulate, white or pinkish to light yellow, the recurved segments lightly barred with lavender; lip white and yellow with reddish transverse bars. **Sepals** oblong to lanceolate, the apical margins often involute; dorsal 3.5–5 cm long, about 1 cm wide; lateral sepals somewhat oblique 3.5–5 cm long, about 1 cm wide, acute. **Petals** elliptic-lanceolate, 3.2–4.5 cm long, about 1 cm wide; apical margins somewhat involute; apex acute to attenuate. **Lip** hinged to the column foot, 3-lobate, about 1 cm long and wide when spread; lateral lobes somewhat clasping the column, rounded to bluntly acute, the midlobe rounded to acuminate, often with involute margin; callus a raised ligule ending at about the sinuses of the lobes, 3-dentate in front, papillose on the lower ⅓. **Column** arcuate, 8–10 mm long excluding the anther; anther about 2.5 mm in diameter.

Epiphytic and terrestrial in cloud forests at 1000–2100 m. Flowering January to March and August to October. Apparently more common in Panama than in Costa Rica, if available herbarium specimens are an indication. Also reported from Colombia and Ecuador as *M. bradeorum* (Schltr.) L. O. Williams (*sensu lato*).

Maxillaria ampliflora is most similar to *M. bradeorum* (Schltr.) L. O. Williams, a species with smaller flowers, more purple in the floral segments, and a lip with a proportionately smaller midlobe. These species are sympatric.

Maxillaria anceps Ames & C. Schweinf., Sched. Orch. 10:84. 1930. TYPE: Costa Rica, La Palma A. *M. Brenes* (133) 463 (holotype: AMES,

photo; isotype: CR). Not *Ornithidium anceps* Rchb. f. Figure 16A.

Plant large, epiphytic, with ascending shoots each terminated by a pseudobulb and borne 3.5–7 cm apart; rooted to the substrate only on lower shoots. Roots white, to 2 mm in diameter. **Pseudobulbs** ovoid, 1-foliate, strongly compressed, shiny, 2–5.5 cm long, 1–2.5 cm wide, subtended by rhizome bracts, which are soon deciduous along the oblique articulation, the apex 1-foliate. **Leaves** subcoriaceous, narrowly elliptic to oblong, shortly petiolate, the blade 6–30 cm long and 1–3.5 cm wide, apically obtuse to unequally bilobed. **Inflorescences** 1 per each of several rhizome bracts of the newly forming shoot; scapes 1–5 cm long, covered by 3 or more acute sheaths and usually concealed by the rhizome bract; ovary with pedicel 2.5–4 cm long, much longer than the subtending bract. **Flowers** fragrant, greenish white to yellow. **Sepals** lanceolate-ovate, 1.8–2.1 cm long, 6–7 mm wide. **Petals** elliptic-oblong, 1.6–1.8 cm long, 4–5 mm wide. **Lip** hinged to the column foot, ovate, strongly 3-lobate on the apical third, 1.5–1.7 cm long, 7–9 mm wide, thickened at the base, glabrous inside; callus orbicular just below the middle (difficult to rehydrate in pressed specimens). **Column** arcuate, about 1 cm long; foot about 2 mm long. **Capsule** ellipsoid, 3 cm long.

Large clump-forming epiphyte of tree trunks and larger branches in wet forests at 1000–1600 m. Flowering November to February. Guatemala to Costa Rica.

Maxillaria nagelii L. O. Williams, ranging from Mexico to Guatemala and El Salvador, is a similar middle elevation species with similar orbicular callus but with distinctly acute perianth segments and less distinctly 3-lobate lip. *Maxillaria anceps* also resembles *M. alba* (Hook. f.) Lindl., a species with white flowers and longer, more acute floral segments, a more pronounced 3-lobate lip, and ligulate callus extending beyond the middle. *Maxillaria anceps* also is more restricted in flowering season, geography, and elevation than the widespread *M. alba*.

Maxillaria angustisegmenta Ames, Hubbard, & C. Schweinf., Sched. Orch. 10:86–87. 1930. TYPE: Costa Rica, La Palma, A. M. Brenes (132) 462 (holotype: AMES). *Maxillaria endresii* Rchb. f. var. *angustisegmenta* (Ames, Hubbard & C. Schweinf.) C. Schweinf., nom. *Maxillaria luteoalba* of authors, not Lindl. Figure 20C.

Plant a densely caespitose epiphyte with approximate shoots. Roots white, to 1.5 mm in diameter. **Pseudobulbs** 1-foliate, conic to ovoid, rarely approaching orbicular, somewhat compressed, 2–7 cm long and 1.5–2.5 cm wide, partially concealed at the base by several smooth, chartaceous, minutely spotted, triangular, acute

bracts 3–10 cm long, shredding with age. **Leaves** long (rarely short) petiolate; petiole sometimes more than $\frac{1}{2}$ the length of the blade; blade oblong-elliptic, 15–24 cm long and 2.5–6 cm wide, acute. **Inflorescence** 1-flowered, the scapes 4–15 cm long, concealed by 4–6 inflated and minutely spotted bracts; ovary with pedicel 2–3 cm long, enclosed and concealed by the floral bract before pollination. **Flowers** fragrant, mostly white, the inner surface of the sepals yellow, the lip yellow and centrally lined with purple on the side lobes, column white to purple. **Sepals** similar; dorsal elliptic-oblong, somewhat concave, 3–5 cm long, 7–10 mm wide, acute to obtuse; lateral sepals oblong, tapering from about the middle to a broadly acute apex, 3–5 cm long, 6–10 mm wide at the base. **Petals** narrowly elliptic, falcate, strongly incurved, 4 cm long and 4–7 mm wide, acute. **Lip** obovate, sharply 3-lobate on the apical quarter, 2.1–2.6 cm long, 12–18 mm wide; midlobe about 6 mm long, 6.5 mm wide; callus on the lower $\frac{1}{2}$ puberulent, raised, thickened, and V-shaped in front. **Column** 1.8–2 cm long, including the 5–8-mm foot. **Capsule** 4 cm long.

Epiphyte of larger branches or less often terrestrial, often forming large clumps; mostly in cloud forests from (450)700–1800(2000) m. Flowering from October to March. Costa Rica and Panama.

This species is most similar to the earlier described and probably sister species, *M. luteoalba* Lindl. (TYPE: Venezuela, *Linden* 678, photo seen), which doubtfully occurs in Panama as reported. *Maxillaria luteoalba* has larger flowers and a proportionately larger midlobe and shorter callus in the lip. In Costa Rica *M. angustisegmenta* is easily distinguished from the lower elevation *M. endresii* Rchb. f. by the shorter and usually proportionately broader perianth parts (despite the name) and the proportionately smaller midlobe. The anther bed of *M. endresii* is coarsely and irregularly lacerate but low and minutely dentate in *M. angustisegmenta*. Vegetatively, the pseudobulb of *M. endresii* is nearly always suborbicular and truncate or emarginate, while that of *M. angustisegmenta* is ovoid to conic.

Maxillaria angustissima Ames, Hubbard, & C. Schweinf., Bot. Mus. Leafl. 3:41. 1934. *Maxillaria acutifolia* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:229–230. 1923 (not Lindl., 1839). TYPE: Costa Rica, San Ramón, A. M. Brenes 235 (holotype: B, destroyed; drawing of type: AMES), Brenes 173 (504) (neotype: AMES). Figure 18B.

Plant a caespitose epiphyte; shoots approximate, often pendent, to 30 cm tall. Roots white, to 0.5 mm in diameter. **Pseudobulbs** hidden from view by 3–4 subtending, leaf-bearing rhizome bracts, apically 1-foliate.

Leaves linear, attenuate both toward the base and the apex, 5–25 cm long, 4–11 mm wide, the leaves subtending the pseudobulb with broadened sheaths below the articulation. **Inflorescences** lateral in the rhizome bract axils, the single-flowered scapes 1–3 cm long; ovary with pedicel about 1.5 cm long, subtended by a subequal, acute, floral bract. **Flowers** white to pink, the side lobes of the lip often reddish. **Sepals** dissimilar; dorsal ovate, concave, 9 mm long, 3.5–4 mm wide, apex strongly concave; lateral sepals triangular, adnate to the long column foot, 1.6 cm long, apex acute and strongly concave. **Petals** oblong, about 1 cm long, 3 mm wide, constricted just below the erose apex. **Lip** hinged to the column foot, cuneate, strongly 3-lobate on the apical fifth, 13–14 mm long, 4 mm wide, midlobe broadly acute; callus ligulate, pubescent, rather deep and parabolic in front, extending to just below the base of the midlobe. **Column** 4 mm long; foot 10 mm long. **Capsule** somewhat curved, narrowly ellipsoid, 3.5–4 cm long.

A rare epiphyte of wet forests at 900–1500 m. Flowering August and September. Costa Rica, Panama, and southern Nicaragua (Volcán Mom-bacho).

The very narrow leaves and small, hidden pseudobulbs along with the small white flowers produced in August and September are good features for field recognition.

Maxillaria appendiculoides C. Schweinf., Bot. Mus. Leaff. 4:119–121. 1937. TYPE: hills of San Pedro de San Ramón, Brenes (239) 1427 (holotype: AMES; isotype: NY). Figure 3B.

Plant a straggly, often pendent epiphyte; stems elongate, lacking pseudobulbs, concealed by sheaths. Roots white, to about 1 mm in diameter. **Leaves** distichous, deciduous on the lower stems, thin; blade elliptic to broadly lanceolate, 1–4 cm long, 5–13 mm wide, rounded and unequally 2-lobate apically. **Inflorescence** 1 per leaf axil, shorter than the subtending leaf; peduncle 1–2 cm long; ovary with pedicel about 1 cm long, subtended by a somewhat shorter, acute bract. **Flowers** yellow or greenish; lip with purple. **Sepals** ovate-lanceolate, somewhat concave, ovate-lanceolate, 8–9 mm long, 3–3.5 mm wide, lateral sepals somewhat oblique, acute. **Petals** narrowly elliptic-linear, somewhat falcate, acute, 6.5–7.5 mm long, 1.5–1.75 mm wide. **Lip** hinged to the foot, rhombic-ovate in outline when spread, somewhat 3-lobate above the middle, 6 mm long, 4.5–5 mm wide when spread; lateral lobes rounded and somewhat clasping the column; midlobe subquadrate, rounded to truncate; callus simple, from near the base to about the middle, ligulate, rounded in front. **Column** about 4 mm long excluding the anther; foot 2–2.5 mm long. **Capsule** ellipsoid about 1.5 cm long, separating into 6 valves, with persistent column.

Epiphytic and apparently rare in premontane rain forests around 800–1600 m. Flowering Au-

gust to November. Endemic to Costa Rica, although it may not have caught the eye of collectors because of its understated appearance.

Maxillaria appendiculoides is closely related to *M. luteorubra* (Lindl.) Rchb. f. from South America, a species with somewhat larger flowers. It is easily distinguished from sympatric *M. linearifolia* Ames & C. Schweinf. by the shorter and more elliptic leaves and lower elevation range.

Maxillaria arachnitiflora Ames & C. Schweinf., Sched. Orch. 10:87–89. 1930. TYPE: Costa Rica, Navarro, C. H. Lankester 1212 (holotype: AMES). Figure 24C.

Plant a caespitose epiphyte, not forming large clumps. Roots white, to 1 mm in diameter. **Pseudobulbs** slender, to 4.5 cm long, concealed and subtended by 1–2 leaf-bearing rhizome bracts. **Leaves** petiolate, the petiole to $\frac{1}{2}$ the blade length; blade narrowly to broadly elliptic, 8–20 cm long and 2–3.5 cm long, acute. **Inflorescence** usually not longer than the leaves, 5–8 cm long, nearly concealed by 5–6 obtuse, apiculate bracts 1–3 cm long; ovary with pedicel 2–3 cm long, surpassed by the subtending bract. **Flowers** with sepals creamy yellow, the petals white, lip yellow, column with maroon at base. **Sepals** 5.5–7 cm long, acuminate, apically spiraled or pendent; dorsal 8 mm wide, the lateral sepals 1.4 cm along the column foot. **Petals** acuminate, abruptly narrowed below the middle, about 4 cm long and 6 mm wide. **Lip** obovate, 1.8 cm long and 1 cm wide, 3-lobate on the apical quarter, the apex thickened; callus sparsely pilose, ligulate, thickened and raised in front, to just above the lower $\frac{1}{2}$ of the lip. **Column** arcuate, 9 mm long from the receptacle and passing into a laterally and shallowly sigmoid foot 12–14 mm long; pollinia 4, supported on a saddle-shaped viscidium.

Very little known; cloud forests at 400–1400 m. Flowering August to October and March. Costa Rica and Panama.

This species is most similar to *M. chionantha*, *M. pachyacron*, and *M. reichenheimiana*, but the leaves are unspotted, the callus reaches to just above middle of the lip, the sepals and petals are more acuminate, the tips are often spiraled or pendent, and the column foot is extremely pronounced and somewhat sigmoid.

Maxillaria attenuata Ames & C. Schweinf., Sched. Orch. 10:89–90. 1930. TYPE: Costa Rica, La Palma, Brenes 512 (holotype: AMES; isotype: NY). Figure 23B.

Plant a small, caespitose epiphyte usually forming small clumps. Roots white, to about 0.75 mm in diameter. **Pseudobulbs** ovoid, to about 1 cm long, partially concealed at the base by 1–2 foliate sheaths, 1-foliate

apically. **Leaves** petiolate; petiole to about $\frac{1}{4}$ the length of the blade and narrowed above the articulation of foliate sheaths; blade elliptic, about 2–7 cm long, 5–10 mm wide, acute. **Inflorescence** apparently single per leaf axil; peduncle 4–7 cm long; somewhat scurfy ovary with pedicel about 1.7–1.9 cm long at anthesis, subtended by a somewhat shorter, obtuse floral bract. **Flowers** not opening widely, brick red or greenish-stained with maroon. **Sepals** lanceolate-attenuate, acute; dorsal concave at the base, 1.6–2 cm long, 3.5–4 mm wide; lateral sepals somewhat falcate, 1.8–2.2 cm long, 5 mm wide. **Petals** lanceolate, falcate, attenuate, 1.4–1.7 cm long, 2.5 mm wide, acute. **Lip** elliptic to rhombic, attenuate, obscurely 3-lobate at about the middle, 1.4–1.5 cm long, 5–6 mm wide when spread, the apex acute and keeled; callus simple, ligulate, rounded and thickened in front, terminating at or below the middle. **Column** stout, about 4.5–5 mm long without the anther; foot about 5 mm long. **Capsule** more than 3 cm long.

Epiphytic in wet, premontane rain forests at 1000–1300 m, often partially concealed by the thick mats of epiphytic mosses in which it grows. Flowering August to December. Costa Rica; also reported from South America.

Maxillaria attenuata is recorded from Venezuela and Bolivia and may be conspecific with the earlier name *M. guadalupensis* Cogn. as accepted by Garay and Dunsterville (Venez. Orch. III. 6: 250). A Bolivian plant illustrated as *M. attenuata* (Icones Plantarum Tropicarum, Series II, Plate 251. 1989) is probably the same species, but the lip has a proportionately longer midlobe. Plants from Venezuela are recorded from 2285 m.

Maxillaria bicallosa (Rchb. f.) Garay, *Caldasia* 8:527. 1962. *Zygopetalum bicallosum* Rchb. f., *Otia Bot. Hamb.* 1:9. 1878. TYPE: Ecuador, near Guayaquil, Lehmann (holotype: w). *Kefersteinia bicallosa* (Rchb. f.) Rchb. f. *Otia Bot. Hamb.* 1:31. 1878. Figure 18D.

Plant epiphytic, caespitose, psygmoid, 20–40 cm tall. Roots filiform, to 1.5 mm in diameter. **Leaves** equitant, with unspotted, papery-margined sheaths 3–6 cm long at the base; blade thin, spreading, linear-oblongate, to 45 cm long, 7–13 mm wide. **Inflorescences** 2 or more within each leaf axil; scapes 2–4 cm long; pedicellate ovaries (1?) 2.5–3 cm long, much exceeding the subtending acute bract. **Flowers** wine red. **Sepals** similar, elliptic lanceolate, 9–10 mm long, 2.5–3 mm wide, acute. **Petals** elliptic, about 8 mm long, 2 mm wide, acute. **Lip** narrowly ovate, slightly constricted above the middle, 8–9 mm long, 3–4 mm wide, with rounded apex; with ligulate callus from the base to about $\frac{2}{3}$ the lip, apex rounded to somewhat 2-lobate. **Column** cylindrical, about 5.5 mm long excluding the anther (1 mm long); foot nearly obsolete. **Capsule** linear, about 2.5 cm long.

Epiphytic in cloud forests at 1100–1200 m. Flowering September and October. Costa Rica (southern) and Panama; also western Ecuador (600 m).

Maxillaria bicallosa is most closely related to *M. chartacifolia* Ames & C. Schweinf. but differs in its narrower leaves, which lack spots at the base and have much shorter scapes and wine-red flowers. The type sheet at Vienna shows broader leaves than those from Costa Rica.

Maxillaria biolleyi (Schltr.) L. O. Williams., *Ann. Missouri Bot. Gard.* 28:425. 1941. *Ornithidium biolleyi* Schltr., *Repert. Spec. Nov. Regni Veg.* 9:29–30. 1910. TYPE: Costa Rica, near San José, *Biolley 1052* (drawing of type: AMES). *Camaridium biolleyi* (Schltr.) Schltr., *Beih. Bot. Centralbl.* 36:498. 1918. Figure 5A.

Plant an erect to pendent epiphyte lacking pseudobulbs (juveniles?); mature stems apparently monopodial, rather thick and concealed by imbricate leaf sheaths. Roots to about 1 mm in diameter. **Leaves** conduplicate, lacking distinct petioles, deciduous, especially on the lower stem; blades above the articulation 5–28 cm long, 1.5–3.2 cm wide, obtuse and unequally 2-lobate. **Inflorescences** 2–many per leaf axil, shorter than the subtending leaf; scape 5–7 cm long; ovary with pedicel 6–7 mm long, subtended by a somewhat membranaceous floral bract about 1.1 cm long. **Flowers** white or pinkish with pink or salmon lip. **Sepals** similar, oblong-lanceolate, 1.3–1.5 cm long, 3–3.5 mm wide, acute. **Petals** elliptic-lanceolate, 1.1–1.2 cm long, 2.5–3 mm wide, acute to attenuate. **Lip** somewhat flexible with the column foot, 3-lobate below the middle, about 5 mm long and 5 mm across when spread; lateral lobes basal and erect around the column, rounded; midlobe bilobed, rounded to emarginate; callus between the lateral lobes, simple, raised, heart-shaped. **Column** stout, 1.5–2 mm long without the anther; foot less than 1 mm long.

Epiphytic and terrestrial at 1600–2200 m. Flowering October to February. Costa Rica and Panama.

Maxillaria biolleyi has long been confused with *M. adolphii* (Schltr.) Ames & Correll, *M. falcata* Ames & Correll, and *M. quadrata* Ames & Correll, but the smaller flowers on long scapes and the relatively simple lip with heart-shaped callus distinguish it from these.

Maxillaria brachybulbon Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 19:55. 1923. TYPE: Costa Rica, San Jeronimo, *Wercklé 23* (drawing of type: AMES). Figure 25A.

Plant a small caespitose epiphyte 4–8 cm tall. Roots white, to about 0.75 mm in diameter. **Pseudobulbs** minute, compressed, about 0.5 cm tall, apically 1-foliate,

and subtended by usually 2 leaf-bearing sheaths. **Leaves** oblong-ob lanceolate, shortly petiolate, and obtuse, 2–8 cm long and 0.4–0.8 cm wide. **Inflorescence** apparently arising on immature growth only, the scapes single per rhizome bract, covered by up to 4 tubular, chartaceous sheaths; ovary with pedicel shorter than the floral bract, 1.1–1.6 cm long. **Flowers** pale yellow or greenish, sometimes striped with purple, the lip basally lined with purple and the midlobe yellow. **Sepals** similar, acute; dorsal elliptic, 1.4–1.6 cm long, 3–4 mm wide; lateral sepals oblong-lanceolate, 1.6–2 cm long, 3–4 mm wide. **Petals** narrowly elliptic, 1.5 cm long, 2.5 mm wide, acute. **Lip** hinged to the column foot, about 1 cm long, the midlobe fleshy and 3.3 mm long; callus ligulate on lower $\frac{2}{3}$, parabolic and thickened apically. **Column** cylindric, flattened beneath, 7 mm long including the foot (2 mm long); anther cap 1.5 mm long; pollinia 4, lacking a stipe but supported on a saddle-shaped viscidium. **Capsule** ellipsoid, about 2 cm long.

Apparently rare epiphyte in rain forests at 50–1000 m. Flowering throughout the year. Honduras to Panama; also reported from Venezuela and Brazil.

This species has been recognized by authors as the South American *M. xylobiflora* Schltr., a somewhat larger species with linear leaves. *Maxillaria brachybulbon* has a generally larger flower and a proportionately longer midlobe than does the closely related *M. pterocarpa* Barb. Rodr., often misidentified as *M. brachybulbon*.

Maxillaria bracteata (Schltr.) Ames & Correll, Bot. Mus. Leaflet 11:14, 1943. *Ornithidium bracteatum* Schltr., Repert. Spec. Nov. Regni Veg. 9:217–218. 1911. TYPE: Costa Rica, La Palma, Tonduz 12344 (lectotype: US). *Camari-dium bracteatum* (Schltr.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:57. 1923. *Maxillaria vagans* Ames & C. Schweinf., Sched. Orch. 8: 65–66. 1925. TYPE: Panama, Chiriquí, Powell 348 (holotype: AMES). Figure 16C.

Plant a somewhat ascending, cane-forming epiphyte to about 50 cm tall comprised of shoots 3–15 cm long, each terminated by a pseudobulb. Roots white, to about 1 mm in diameter. **Pseudobulbs** parallel with the continuing rhizome, fusiform to conic, compressed, 1-foliate, 2.5–5(7) cm long, 1–2(4) cm wide, subtended by 1–4 strongly rugose sheaths with soon deciduous blades. **Leaf** blades shortly petiolate, chartaceous, linear-oblong, 3–20 cm long, 1–3 cm wide, the apex unequally 2-lorate. **Inflorescences** 1–3 per foliaceous sheath axil, 3–8 cm long; ovary with pedicel 8–12 mm long. **Flowers** with somewhat spreading segments, white to pale yellow with red or pink marks, especially the lip. **Sepals** similar, oblong to oblanceolate, 1.7–2.2 cm long, 5–6 mm wide, acute; dorsal somewhat keeled dorsally and apically. **Petals** oblong-ob lanceolate, 1.5–1.7 cm long, about 4 mm wide, acute. **Lip** ovate in general outline, 3-lobate

below the middle, 1.1–1.2 cm long, 6–7 mm wide when spread; lateral lobes rounded, somewhat erect and embracing the column; midlobe fleshy, rounded, abaxially keeled; callus fleshy, truncate in front at about the same level as the divergence of the lateral lobes, with a blunt central keel. **Column** stout, arcuate, 4–5 mm long excluding the anther; foot about 2 mm long.

Common epiphyte of larger branches at 1300–2700 m. Flowering throughout the year. Costa Rica and Panama.

Maxillaria bracteata is often seen on forest remnants in pastures. In Costa Rica it is most similar to *M. gomeziana* J. T. Atwood, a species with trigonous ovaries and statistically narrower leaves. It strongly resembles *M. imbricata* Lindl. from South America, but none of the available illustrations of that species show the blunt keel of the callus. For the moment these are best kept separate.

This has long been known by the later synonym, *M. vagans* Ames & C. Schweinf. The appearance of an isotype of *M. bracteata* (US) consistent with Schlechter's original description shows that this name has been badly misapplied to other species (see Atwood, Lindleyana 9:239–242, 1994).

Maxillaria bradeorum (Schltr.) L. O. Williams, Ann. Missouri Bot. Gard. 28:425. 1941. *Camari-dium bradeorum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:141–143. 1923. TYPE: Costa Rica (photo of type: AMES). *Maxillaria semiorbicularis* Ames & C. Schweinf., Sched. Orch. 8:64–65. 1925. TYPE: Costa Rica, Province of San José, La Hondura, Standley 36247 (holotype: AMES). Figure 14D.

Plant a straggly terrestrial or epiphyte to at least 1.5 m long forming erect to decumbent canes comprised of successively borne shoots, each shoot terminated by a pseudobulb. Roots forming only on the lowest shoots, to 2 mm in diameter. **Pseudobulbs** ovoid to suborbicular, compressed, to about 5 cm long; base subtended by several leaves; apex 1(–2?)-foliate. **Leaves** distinctly and shortly petiolate, conduplicate; blade narrowly elliptic, increasing in size toward apex within each shoot, to about 20 cm long, 4.5 cm wide, acute. **Inflorescence** 1 per bract axil, subtended by a foliaceous bract with distinct articulation; scapes sheathed in acute bracts, to about 7 cm long; ovary with pedicel (1)1.2–1.7(2.2) cm long, exceeded by the subtending floral bract. **Flowers** variable in color, white to light yellow, the tepals stained with pink to lavender apically or spotted; lip yellow and with reddish transverse bars. **Sepals** oblong to lanceolate; dorsal 2.2–3.1 cm long, 8–9 mm wide; lateral sepals somewhat oblique 2.1–3.2 cm long, 8–10 mm wide, acute. **Petals** elliptic-lanceolate, 1.9–3 cm long, 7–10 mm wide; apical margins somewhat involute; apex acute

to attenuate. **Lip** hinged to the column foot, 3-lobate, when spread 7–9 mm long, 1–1.3 cm wide; lateral lobes clasping the column, the outer margin rounded, acute, the midlobe subtriangular with acuminate apex; callus a raised ligule ending below the sinuses of the lobes, 3-dentate in front, papillose on the lower $\frac{2}{3}$. **Column** arcuate, 8–10 mm long excluding the anther; foot (2.5)3–4 mm long; anther about 2 mm in diameter.

Epiphytic and terrestrial in premontane and lower montane rain forests at 700–1800 m. Flowering at least July to November, January, and March. Costa Rica and Panama.

Maxillaria bradeorum is closely related to sympatric *M. ampliflora* C. Schweinf. but has consistently smaller flowers, usually with more pink or lavender. The lateral lobes of the lip are proportionately longer and more acute than in *M. ampliflora*.

Apparently Schlechter's type had a pair of leaves at the pseudobulb apex, a feature not otherwise seen among plants interpreted here as *M. bradeorum*. The extant type drawings at AMES of *Camaridium bradeorum* showing the lip with smaller, more acuminate midlobe nicely distinguish this species from *M. ampliflora* C. Schweinf. Ames and Schweinfurth argue in their original description that their *M. semiorbicularis* differs from *C. bradeorum* by the "smaller leaves, monophyllous pseudobulbs, and different midlobe." However, leaf size is generally extremely variable in *Maxillaria*, and Schlechter appears to have had an oddity in the 2-foliolate pseudobulbs. There is nothing in the original description of *M. semiorbicularis* to support differences in the midlobe of the lip with that of *M. bradeorum*.

Maxillaria brevilabia Ames & Correll, Bot. Mus.

Leaf. 11:15, fig. 1. 1943. *Ornithidium alfaroi* Ames & C. Schweinf., Sched. Orch. 10:98. 1930. TYPE: Costa Rica, La Fuente, *Alfaro* 227 (holotype: AMES). Not *Maxillaria alfaroi* Ames & C. Schweinf., Sched. Orch. 10:83–84. 1930. Figure 9B.

Plant a somewhat creeping or lax cane-forming epiphyte to 50 cm tall; shoots forming an elongate scale-covered rhizome to 7 mm in diameter. Roots to 1 mm in diameter. **Pseudobulbs** ancipitous, elliptic-cylindric, 3–6 cm long, 1–3 cm broad, spaced 2–5 cm apart, sheathed at the base when young by a pair of enlarged nonfoliaceous bracts, apically 1-foliolate. **Leaf** shortly petiolate; blade chartaceous in dried specimens, narrowly elliptic, 4–17.5 cm long, 1.3–3.5 cm wide, obtuse or rounded, rarely bluntly acute. **Inflorescences** developed along the entire mature rhizome and usually densely so; scapes less than 5 mm long, hidden by the rhizome

scales; ovary with pedicel 3–3.5 mm long concealed by inflated scape bracts. **Flower** white sometimes with pink or maroon flush at base of the segments, the lip orange-yellow. **Sepals** ovate-lanceolate; dorsal 6.5–8 mm long, about 2.5–3 mm wide; lateral sepals about $\frac{1}{2}$ connate, 8–9.5 mm long. **Petals** oblong, 5.5–6.5 mm long, 1.5–2 mm wide, subacute. **Lip** subovate when spread, 5–5.5 mm long, 3.5–4.5 mm wide, forming an acute angle with the column foot, the apical third 3-lobate; lateral lobes broadly rounded; midlobe triangular-ovate; callus fleshy, transverse across the base of midlobe. **Column** stout, about 2 mm long excluding the anther; foot about 2 mm long.

Epiphytic in montane rain forests, often in association with oaks, Lauraceae and *Chusquea*, at 1000–2350 m. Flowering mostly August to January. Costa Rica (Volcán Poás) to Panama (Boquete).

Maxillaria brevilabia is easily distinguished from other members of the *M. neglecta* (Schltr.) L. O. Williams complex by the relatively large, cylindric pseudobulbs and broadly elliptic leaves. Inflorescences develop along the entire length of the most recently matured rhizome segment, and the lip forms a sharp angle with the column foot, unlike related species.

Maxillaria brunnea Linden & Rchb. f., Bonplandia 2:281. 1854. TYPE: Colombia, Ocaña, *Schlim* 1161 (holotype: w). ?*Maxillaria porrecta* Lindl., Bot. Reg. 24: misc. 92. 1838. TYPE: Brazil(?), "Rio Janeiro," *Loddiges s.n.* (holotype: k). *Maxillaria trinitatis* Ames, Sched. Orch. 2:34–35. 1923. TYPE: Trinidad, British West Indies, heights of Aripo, *W. E. Broadway* 9890 (holotype: AMES). *Maxillaria brenesii* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 56, 231–232. 1923. TYPE: Costa Rica, San Pedro de San Ramón, *Brenes* 78 (lectotype: CR; isoelectotype: AMES). Figure 21A.

Plant a densely caespitose epiphyte sometimes producing large clumps. Roots white, to about 1 mm in diameter. **Pseudobulbs** ovoid, little compressed laterally, 2.5–6 cm long, subtended by short, spotted, acute sheaths; apex 1-foliolate. **Leaves** distinctly petiolate; petiole 1–20 cm long; blade narrowly elliptic, usually glaucous beneath, 16–34 cm long, 2–5.5 cm wide, acute. **Inflorescences** appearing in the bract axils of the recently completed shoot; scapes 8–17 cm long, concealed by 5–8 bracts of about the same length or increasing gradually; ovary with pedicel 1.8–3.7 mm long. **Flowers** creamy yellow flushed with rose, the lip apex purple beneath. **Sepals** rather dissimilar, somewhat concave; dorsal ligulate, 2.1–3 cm long, 5–6 mm wide, acute; lateral sepals lanceolate-ligulate, oblique, 2.2–3.1 cm long, 5–6 mm wide, acute to obtuse. **Petals** falcate-ligulate, 2–2.5 cm long, 3–4 mm wide, acute. **Lip** generally

obovate when spread, 1.4–1.7 cm long, 7.5–10 mm wide, 3-lobate on the apical $\frac{1}{2}$ – $\frac{3}{4}$; side lobes with margins embracing the column, rounded to truncate; mid-lobe suborbicular, thickened centrally, the margins crenulate; callus sparsely pubescent, ligulate, thickened and somewhat V-shaped apically. **Column** stout, 7–9 mm long excluding the anther; foot about 5 mm long; anther about 3 mm in diameter. **Capsule** ellipsoid, 5–6 cm long.

Locally common and widespread epiphyte on large branches in rain or cloud forests at (300)600–1800 m. Flowering June to March. Nicaragua (expected in Honduras) to Colombia and Trinidad.

Maxillaria brunnea as accepted here may represent more than one species in Costa Rica, one with yellowish flowers with larger bracts (perhaps *M. powellii* Schltr., described from central Panama), the other with much more reddish flowers with smaller bracts and shorter, more abrupt mid-lobe (*M. brenesii* Schltr.). As interpreted for this treatment, *M. brunnea* is characterized by the cespitose habit, single leaf at the pseudobulb apex, the creamy yellow to whitish flowers sometimes tinged with red on the sepals, and dark red abaxial side to the lip apex. Its close relative, *M. longiloba*, has a fleshier and proportionately longer midlobe that is usually sharply reflexed. Specimens from lower elevation are usually smaller, with flowers less tinged with red. Flowers of related *M. ringens* Rchb. f. have longer and proportionally narrower sepals colored white to yellow with the lip much shorter than $\frac{1}{2}$ the lateral sepals, while the lip of *M. brunnea* exceeds $\frac{1}{2}$.

The earliest name for members of the *M. brunnea* complex may be *M. porrecta* Lindl. (G. Carnevali, pers. comm.), an entity based presumably on Brazilian material. Neither Ames nor Schlechter compared their new species with *M. brunnea* or *M. porrecta*.

Maxillaria burgeri J. T. Atwood, Lindleyana 9: 233–236. 1994. TYPE: Costa Rica, Province of Heredia, southern slope of Volcán Barba at 2200 m, W. C. Burger & R. G. Stolze 6062 (holotype: F; isotype: MO). Figure 12C.

Plant an erect (when young), pendent, or decumbent, much branched, cane-forming epiphyte to about 30 cm tall, rooted only on the lower shoots; pseudobulbs to about 5 cm apart on lower but closer in successive shoots. Roots less than 1 mm in diameter. **Pseudobulbs** suborbicular to obovoid, 7–12 mm long, 4–9 mm wide often subtended when young by a foliaceous sheath, the apex 1-foliate. **Leaves** and foliaceous sheaths similar; apical leaf with short petiole; blades thin, elliptic-ob-

long, rounded to emarginate, 1.5–9 cm long, 3–8 mm wide, abaxially keeled. **Inflorescence** single per rhizome bract of both mature and immature shoots, less than 1 cm long; ovary with pedicel 5–7 mm long, exceeded by the subtending, acute, floral bract. **Flowers** not opening widely, with lateral sepals and petals recurved, yellow; lip yellow or with purple-red callus; column white. **Sepals** subequal, elliptic-lanceolate, 10–13 mm long, 2–2.5 mm wide, acute; dorsal somewhat concave; lateral sepals subfalcate. **Petals** elliptic-lanceolate, falcate, acute, 9–12 mm long, 2.25–2.75 mm wide. **Lip** hinged with the column foot, convex, recurved in natural position, ovate when spread, 4–5 mm long, about 3 mm wide, 3-lobate on the lower $\frac{1}{4}$; lateral lobes shorter than the callus; midlobe ovate, reflexed at the base, obtuse or rounded to emarginate; callus fleshy, rounded, and somewhat elevated in front, terminating below the middle. **Column** stout, arcuate, somewhat tapering, 2–3 mm long excluding the anther; foot about 1 mm long.

Poorly known epiphyte of montane rain forests at 1100–2500 m. Flowers May and June. Endemic to Costa Rica.

Maxillaria burgeri is at once distinguished from *M. flava* and *M. microphyton* by the suborbicular to ovoid pseudobulbs, which usually lack a subtending foliaceous bract. Specimens have been identified as *M. microphyton*, but the lip with large midlobe is more similar to that of *M. flava*.

Maxillaria caespitifica Rchb. f., Linnaea 41:73. 1877. TYPE: Costa Rica, Endres (holotype: w). Figure 25D.

Plant a cespitose to shortly rhizomatous epiphyte to about 15 cm high. Roots to about 1 mm in diameter. **Pseudobulbs** fusiform to cylindric, subtended by non-foliaceous sheaths, apically 1-foliate, 1.5–2.5 cm long. **Leaves** thin, usually shortly petiolate, the blade lanceolate, to about 10 cm long, the apex unequally 2-lobate. **Inflorescences** formed in the flush of new growth, to about 2 cm long. **Flowers** yellow or greenish yellow, the lip with red callus. **Sepals** similar, oblong, 5–7 mm long, about 4 mm wide, acute to obtuse; dorsal concave; lateral sepals slightly falcate. **Petals** oblong, 5–6 mm long, about 3 mm wide; apex acute and recurved. **Lip** simple to lightly 3-lobate, more or less straight with the sides somewhat embracing the column, elliptic-ovate, 5–6 mm long, about 3 mm wide, the apex truncate to rounded or retuse; callus a fleshy and shiny ligule on the lower $\frac{1}{2}$. **Column** arcuate, 5–6 mm long excluding the anther; foot about 1 mm long.

Epiphytic but very poorly known; probably from 100 to 1200 m as in Nicaragua. Costa Rica and Nicaragua, possibly Honduras, and reported from South America. Flowering in Costa Rica unknown; January in Nicaragua. The above description is based in part on that by Hamer (Icon. Pl. Trop. 9: pl. 845).

Some authors include this species as a synonym of *M. variabilis* Bateman ex Lindl., but the more caespitose plant and much smaller, usually greenish flower of *M. caespitifica* are rather easy features to recognize in live plants.

Maxillaria camaridii Rchb. f., Hamburger Garten-Blumenzeitung 19:547. 1863. Basionym: *Camaridium ochroleucum* Lindl., Bot. Reg. 10: t. 844. 1824. TYPE: Trinidad, Woodford. *Cymbidium ochroleucum* Lindl., Gen. Sp. Orch. Pl. 168. 1833. *Camaridium affine* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:72–73. 1922. TYPE: Panama, on hills near Panama City, Powell 7 (isotype: AMES). Not *Maxillaria ochroleucum* Lodd. ex Lindl.

Plant a straggly, usually decumbent or pendent epiphyte. Stems elongate, the rhizome 2–15 cm between pseudobulbs. Roots less than 1 mm in diameter. **Pseudobulbs** elliptic-ovate, strongly compressed laterally, 2.5–5.5 cm long, 1.5–3 cm wide; base concealed by several soon-deciduous, foliaceous sheaths; apex 1–2-foliate. **Leaves** short-oblong to long-linear, short-petiolate or not, the blades rarely to 33 cm long, 8–18 mm wide. **Inflorescence** 1 (or more?) per foliaceous bract; scapes to about 5 cm long, mostly included within the rhizome bract; scape bracts acute; ovary with pedicel 1.6 cm long. **Flowers** ephemeral, lasting about a day, white; lip yellow with red or purple bars on lower half and at base of column. **Sepals** dissimilar, elliptic, acute; dorsal somewhat concave, 3.2 cm long, 1.2 cm wide; lateral sepals 3.1 cm long, 1.2 cm wide. **Petals** elliptic-oblong, somewhat falcate, 2.9 cm long, 8.5 mm wide, acute. **Lip** strongly attached to but well distinguished from the column foot, 3-lobate on about the apical $\frac{2}{3}$, 1.4 cm long, 1.3 cm wide when flattened; lateral lobes rounded; mid-lobe rounded in front; callus with rusty hairs on the lower half, the front part broken up into papillae. **Column** cylindric, arcuate, about 1 cm long excluding anther; foot about 2 mm long. **Capsule** ellipsoid, about 3 cm long.

Epiphytic in lowland tropical forests at 0–250 m. Flowering August to November. Most of tropical America north and west to at least Central Panama; reported from Guatemala.

It is distinguished by the canes with pseudobulbs and white, short-lived, fragrant flowers with yellow lip marked with red. The rare *M. suaveolens* Barringer is similar but is a much larger plant with proportionately larger flowers. No specimens of *M. camaridii* have been seen to confirm reports from Costa Rica, but it may occur there.

Maxillaria campanulata C. Schweinf., Bot. Mus. Leaf. 5:94–95. 1938. TYPE: Costa Rica, Jiménez 315 (holotype: AMES). Figure 15B.

Plant a large rhizomatous epiphyte with several branching stems all rooted at the base, each to about 1.5 m long, comprised of successively borne shoots with each terminated by a pseudobulb. Roots to about 1 mm in diameter. **Pseudobulbs** ovoid, compressed, to about 40 cm apart, to 10 cm long and 5 cm wide, mostly concealed by several foliaceous bracts, the apex 1-foliate. **Leaves** coriaceous, keeled abaxially, articulate, petiolate; blades oblong to linear or narrowly elliptic, to 25 cm long, 3.8 cm wide, with sheath blades relatively shortly petiolate, the apical leaf with much more slender petiole, the apex acute to obtuse and mucronate. **Inflorescence** 1 per foliaceous bract axil of the developing shoot; scape to about 10 cm long, longer than the subtending leaf, concealed by acute bracts; ovary with pedicel 1.5–1.8 cm long exceeded by the subtending acute floral bract. **Flowers** campanulate, somewhat nodding with recurved sepals and petals, greenish yellow conspicuously marked transversely with brick red bars. **Sepals** oblong or oblanceolate; dorsal about 2.2 cm long, acute; lateral sepals 2.3–2.5 cm long, attenuate. **Petals** oblong, 1.9–2.1 cm long, 7–8 mm wide, apex bluntly acute to obtuse. **Lip** hinged to the column foot, obovate when spread, 9–10 mm long, 7–8 mm wide, 3-lobate on the upper $\frac{1}{2}$, the sides embracing the column; lateral lobes obtuse; midlobe fleshy, suborbicular, obtuse; callus a truncate or emarginate ligule ending above the middle, extending toward the base where 3 or more low, warty keels are located. **Column** stout, nearly straight, 7–8 mm long excluding the anther; foot 1.5–2 mm long. **Capsule** about 2.5 cm long.

Epiphytic in evergreen forests at 400–1500 m. Conceivably the upper vertical distribution reflects locally warmer microclimates of pastures. Flowering at least August to December. Endemic to Costa Rica.

Maxillaria campanulata belongs to a group of species characterized by the half-lyre-shaped foliaceous bracts subtending the inflorescences, a group that includes *M. ampliflora*, *M. bradeorum*, and *M. umbratilis*. This species usually masquerades as *M. bradeorum*, but the sepals and petals are recurved, the lip is narrower than long when spread, and the callus lacks the shaggy pubescence at the base.

Maxillaria cedralensis J. T. Atwood & D. E. Mora, Selbyana 18:31–32. 1997. TYPE: Costa Rica, Province of San José, Cedral, 2000 m, Apr. 1990, D. E. Mora B-35 (holotype: USJ). Figure 22D.

Plant caespitose forming large clumps, to 30 cm tall. Stems approximate, roots to 1 mm in diameter. **Pseudobulbs** ovate, compressed, 5–7 cm long, 2.5–4 cm wide, subtended by inarticulate, triangular, nonfoliaceous bracts; apex 1-foliate. **Leaf** narrowly elliptic, to 45 cm long, 2.5–4 cm wide, apex bluntly acute. **Inflorescence** 8–10 cm, slightly fractiflex, concealed by bracts; ovary with pedicel 1.5–2 cm long, exceeded by the acute, cucullate, floral bract. **Flowers** creamy white,

the petals spotted with maroon near the base of the tepals; lip cream, spotted with maroon; column spotted with maroon on ventral side. **Sepals** elliptic, acute, with revolute margins, 3.5 cm long, 1.3 cm wide. **Petals** elliptic-lanceolate, acute, about 3 cm long, 0.9 cm wide, the margins revolute. **Lip** 3-lobate, 1.5 cm long, 0.8 cm wide when spread; lateral lobes embracing the column, truncate to somewhat emarginate apically; midlobe about $\frac{2}{3}$ lip length, recurved; callus 2-keeled, canaliculate, exceeding the lateral lobes in front. **Column** arcuate, 1.25 cm long including the anther; foot very short; pollinia 4, supported on a short stipe and viscidium.

Ecology poorly known, apparently epiphytic at about 2000 m. Flowering at least March. Endemic to Costa Rica, where it is known only from Cedral de Aserrí.

Maxillaria cedralensis is unique in the *M. cucullata* complex with its large leaves, cream-colored flowers, and spotted lip with rather narrow midlobe. *Maxillaria cedralensis* differs from related *M. punctostriata* Rchb. f. and *M. obscura* Lind. & Rchb. f. in its sepals with revolute margins.

Maxillaria chartacifolia Ames & C. Schweinf., Sched. Orch. 10:92. 1930. TYPE: Costa Rica, Guanacaste, La Tejona, north of Tilarán, Standley & Valerio 45989 (holotype: AMES). Figure 18C.

Plant a psygmoid, large clumping, cespitose epiphyte to about 40 cm tall, the shoots approximate. Roots to 1.5 mm in diameter. **Pseudobulbs** absent, obsolete, or at least concealed by leafy rhizome bracts. **Leaves** 5 or more per shoot at anthesis, distichous, with long sheaths and petioles, the sheaths strongly conduplicate, spotted, 5–12 cm long and 1.2–2.5 cm from margin to midvein, petiole narrowed just above the articulation, strongly conduplicate, the blade 12–55 cm long and 1.7–4 cm wide, the midvein sulcate above and keeled beneath. **Inflorescence** a fascicle of several usually successively borne single-flowered scapes per rhizome bract axil, 7–13 cm long, concealed by 4–6 acute, scape bracts 1.5–3 cm long; ovary with pedicel 3–4 cm long, much exceeding the subtending bract. **Flowers** short lived, with putrid odor similar to that of strong cheese, yellow at anthesis, aging brownish red. **Sepals** lance-oblong, 1.8–2.2 cm long, 6–8 mm wide, acute. **Petals** elliptic-oblong, 1.3–1.4 cm long, 4.5–5.5 mm wide, acute. **Lip** hinged to the column foot, rhombic-ovate, obscurely 3-lobulate, 1.3–1.4 cm long, 5.5–6.5 mm wide; callus fleshy, extending from the base to apex, with an additional ovate, hard callus superposed at the middle. **Column** arcuate, broadened above, 8 mm long; foot 3–4 mm long, the anther cap 2.5 mm long. **Capsule** linear, 5–6 cm long, expanding into 6 valves and remaining united at the apex.

A large clumping epiphyte of wet forests at 500–1700 m. Flowering September to November,

May, and to be expected throughout the year. Costa Rica to Ecuador.

This species and the closely related *M. bicallosa* (Rchb. f.) Garay have a psygmoid (fanlike) habit with at least 5 thin chartaceous leaves. *Maxillaria bicallosa* has much narrower leaves (rarely exceeding 1.2 cm) than *M. chartacifolia*, and its sheaths are unspotted.

Maxillaria chionantha J. T. Atwood, Selbyana 16:242. 1995. TYPE: Panama, Province of Veraguas, vicinity of Continental Divide, third branch of Río Santa María to drop-off to lowlands, R. L. Dressler 4839 (holotype: SEL). Figure 24D.

Plant epiphytic, cespitose, sometimes densely so, 10–30 cm high. Roots slender, to 1 mm in diameter. **Pseudobulbs** ovoid, compressed, 2–3 cm long, usually concealed by 1–3 subtending, foliaceous, and long petiolate sheaths. **Leaves** long petiolate; petiole $\frac{1}{4}$ – $\frac{1}{2}$ the blade, abruptly narrowed above the articulation; blade elliptic, usually broadly so, 5–13 cm long, 2–5 cm wide, acute and apiculate. **Inflorescence** 1 per rhizome bract; scape 3.5–8 cm long, concealed by acute scape bracts; ovary 1–2.2 cm long, somewhat warty, subtended, and much exceeded by a cucullate, acute, floral bract. **Flowers** campanulate, white aging tan with ivory to light yellow lip. **Sepals** lanceolate, attenuate, 30–45 mm long, 6–8 mm wide, acute; laterals forming a chin 5–7 mm long. **Petals** lanceolate, attenuate, 25–40 mm long, 4–6 mm wide, acute. **Lip** oblong, simple to lightly 3-lobate on the upper $\frac{1}{3}$, about 12 mm long, 5 mm wide when spread; lateral lobes slightly embracing the column; midlobe deltoid, verrucose, with recurved apex; callus a ligule from the base to above the middle, swollen in front. **Column** 7 mm long, 11 mm including foot; foot 4–5 mm long; anther 2 mm long, somewhat hidden from the broadened, dentate anther bed; pollinia 4, supported on a stipe and saddle-shaped viscidium. **Capsule** 4.5–6 cm long.

Epiphytic in premontane evergreen forests at 600–1000 m. Flowering August to February. Costa Rica and Panama.

Maxillaria chionantha closely resembles *M. pachyacron* Schltr., which has usually longer inflorescences, larger flowers with more attenuate segments, and a much more distinctly 3-lobate lip on the upper $\frac{1}{6}$. *Maxillaria pachyacron* also has shorter pseudobulbs and grows at higher elevations. *Maxillaria chionantha* is also closely related to *M. attenuata* Ames & C. Schweinf., a species that also has distinctly petiolate leaves, attenuate floral segments, and a nearly simple lip, but is easily distinguished by the larger plant and larger and white flowers, rather than the red to maroon flowers of the latter species.

Maxillaria concavilabia Ames & Correll, Bot. Mus. Mehl. 11:15, fig. 2. 1943. *Ornithidium stenophyllum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:59. 1923. TYPE: Costa Rica, San Jeronimo, Wercklé 109 (drawing of type: AMES). Not *Maxillaria stenophylla* Rchb. f. 1854. Not *Maxillaria stenophylla* F. Lehm. & Kraenzl. 1899. Figure 9E.

Straggly, rhizomatous epiphytes rooted only at the basal shoots; bract-covered rhizome elongate, to 4 mm in diameter. **Roots** fibrous, to 0.5 mm in diameter. **Pseudobulbs** cylindric to ovoid, somewhat compressed, 1-foliate, (8)10–30 mm tall, 6–12 mm wide, spaced 1–5 cm apart, subtended and concealed when young by a pair of subulate bracts. **Leaves** shortly petiolate; blade lance-linear, strongly acute, 4–14 cm long, 7–15 mm wide. **Inflorescence** fasciated at the base of the pseudobulb, each scape less than 5 mm tall and concealed by the rhizome bracts; ovary 2–3 mm long. **Flowers** membranaceous, white or lip with yellow midlobe. **Sepals** dissimilar, not much spreading, apiculate; dorsal elliptic, (3?)6–7 mm long, 2 mm wide; lateral sepals oblong-ovate, 6–6.5 mm long, about 2.5 mm wide, about ½ connate. **Petals** linear, 4.5–6 mm long, about 1 mm wide, apiculate. **Lip** relatively fleshy, concave, 3-lobate, 2–2.5 mm long excluding the foot; lateral lobes suborbicular when viewed laterally; midlobe reflexed, bluntly acute; callus at the base apparently transverse connecting the lateral lobes. **Column** stout, 1–1.2 mm long excluding the anther, extended at the base into a foot about 1.5 mm long, strongly curved forward.

Epiphytic at 1400–2300 m, often in oak forests with *Chusquea* understories. Available specimens with flowers in good condition were all collected in August. Known only from Costa Rica from the Cordillera de Talamanca south of Cartago to the Panama border, but expected in Panama.

Maxillaria concavilabia has been confused with vegetatively similar *M. neglecta* (Schltr.) L. O. Williams, a low-elevation species with similar flower color. However, *M. concavilabia* has smaller flowers that are more membranaceous in dried specimens and therefore are difficult to rehydrate. The lip has pronounced rounded lateral lobes when viewed laterally, and the column foot is more antrorsely curved from the base. Similar *M. parviflora* (Poeppig & Endl.) Garay is a low-elevation species lacking the rounded lateral lobes.

Maxillaria conduplicata (Ames & C. Schweinf.) L. O. Williams, Ann. Missouri Bot. Gard. 29: 348. 1942. *Ornithidium conduplicatum* Ames & C. Schweinf. Sched. Orch. 8:66–68. 1925. TYPE: Panama, Chiriquí, Powell 341 (holotype: AMES). Figure 5D.

Plant poorly known, probably with canes to at least 50 cm tall. Canes mostly hidden from view by the somewhat inflated leaf sheaths (in dried material). Roots on canes to about 2 mm in diameter. **Pseudobulbs** apparently restricted to the base of the plant and formed only in the juvenile stage, ovoid, 5.5 cm long ($n = 1$), apically 1-foliate. **Leaves** congested or not ($n = 2$), the lower abscising early; sheaths rugose, somewhat inflated in the dried specimen; blade subcoriaceous, oblong, to 20 cm long and 2.7 cm wide, acute to obtuse or 2-lobate. **Inflorescence** a fascicle of several single-flowered scapes in leaf axils; scapes to 4 cm long, concealed by acute bracts; ovary with pedicel 8–9 mm long, subtended by a much shorter bract. **Flowers** globose, light yellow, with light pink on outside of sepals and petals; lip yellow. **Sepals** somewhat fleshy apically, similar, ovate, acute; dorsal somewhat concave, 5.9–6.5 mm long, 2.5–3 mm wide; lateral sepals about 7 mm long, 3 mm wide. **Petals** elliptic-ovate, acuminate, about 6 mm long, 2.5–3 mm wide. **Lip** somewhat hinged to the column foot, 4-lobate when spread, subquadrate, the basal lobes somewhat embracing the column and forming a shallow cup, the apical ½ somewhat conduplicate in front; callus at the base a simple thickening connecting the lateral lobes in front; also an apical, cushion-like callus in front. **Column** stout, about 1.5 mm long excluding the anther; foot about 1 mm long; anther about 1 mm long.

Maxillaria conduplicata is known from Panama and Costa Rica at 1200–1500 (3000) m. A live plant collected in a cloud forest at Cerro de la Muerte at about 3000 m survived two summers at Sarasota, Florida, where it flowered in November 1996. Based on this and two available herbarium specimens, it appears to flower from September to November. It may be much more common than available specimens would indicate, as the rather large plant with small, inconspicuous flowers probably does not catch the eye of collectors.

Maxillaria confusa Ames & C. Schweinf., Sched. Orch. 8:57–58. 1925. TYPE: Costa Rica, Peralta, Lankester 908 (holotype: AMES). Figure 23C.

Epiphytes rarely forming large clumps. Roots to about 1 mm in diameter. **Pseudobulbs** apically 1-foliate, truncate, compressed, ovoid, 1–3 cm long, provided basally with 1–2 foliate bracts. **Leaves** petiolate, those subtending the pseudobulb constricted above the articulation; petioles to about ½ the blade length; blades elliptic-oblancheolate, cuneate, 3–17 cm long, 1.3–3 cm wide, acute to obtuse. **Inflorescences** lateral, several per bract axil, each covered with 4–5 pale green bracts; scapes 3–7 cm long; ovary with pedicel 1.5–1.7 cm long. **Flowers** white to yellowish aging brownish, the lip with purple markings. **Sepals** dissimilar; dorsal elliptic-lanceolate, concave, 1.8–2.2 cm long and about 5 mm wide, the lateral sepals triangular-lanceolate, somewhat attenuate, 2–2.5 cm long and 5 mm wide at the base forming a

conspicuous, pointed chin. **Petals** lanceolate-falcate, 1.5–2 cm long and about 4 mm wide. **Lip** articulated with the column foot, obovate, cuneate, strongly 3-lobate on the apical $\frac{1}{2}$, 12–15 mm long and about 6 mm wide when spread; lateral lobes embracing the column; midlobe verrucose, suborbicular; callus ligulate, thickened and rounded in front, ending just above the middle, somewhat pubescent. **Column** stout, about 5 mm long excluding the anther; foot 6–9 mm long; anther rough-papillose, about 2 mm long, the anther bed conspicuously fringed; pollinia with short, squarrose stipe and horseshoe-shaped viscidium. **Capsule** about 4 cm long.

Rather common yet somewhat inconspicuous epiphyte of premontane rain forests at (150)500–1450 m. Flowering January to September, probably throughout the year. Belize to Panama.

Maxillaria confusa is similar to *M. ramonensis* Schltr. but has larger flowers with fringed anther bed.

Maxillaria costaricensis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:232–233. 1923. TYPE: Costa Rica, District of Volis in San Ramón, 1050 m, *Brenes* 237 (lectotype: CR, not seen; isotypes: AMES, NY). Figure 11D.

Plant a somewhat straggly epiphyte to about 25 cm high, sometimes forming large clumps. Roots to about 1 mm in diameter. **Pseudobulbs** fusiform to cylindric; to 3 cm apart, subtended by nonfoliaceous sheaths, apically 1-foliate, 1.5–3 cm long, to 1 cm wide. **Leaves** thin, usually shortly petiolate, the blade linear-lanceolate, 5–14 cm long, 5–9 mm wide, the apex obtuse to unequally 2-lobate. **Inflorescence** formed in the flush of new growth, to about 2 cm long; ovary with pedicel 1.5–2 cm long. **Flowers** green to cream or rose (old flowers?) tinted with red, the lip dark maroon. **Sepals** similar; dorsal concave oblong, 1–1.3 cm long, about 3–4 mm wide, acute to obtuse and apiculate; lateral sepals lanceolate to falcate, 1.1–1.4 cm long, 4–4.5 mm wide, acute. **Petals** oblanceolate, 1–1.2 cm long, about 3 mm wide, apex acute to obtuse and somewhat recurved. **Lip** simple to 3-lobate, more or less straight with the sides somewhat embracing the column, elliptic-ovate, 1–1.2 cm long, 4.5–5.5 mm wide; apex truncate to rounded; callus a fleshy and shiny ligule on the lower $\frac{1}{2}$. **Column** arcuate, 7 mm long excluding the anther, the foot 2 mm long; anther about 2 mm in diameter. **Capsule** ellipsoid, about 1.5–2 cm long.

Epiphytic in rain and cloud forests at 500–1600 m. Flowering January to May and November. Endemic and apparently restricted to Costa Rica north of the Central Valley.

Maxillaria costaricensis is recognized by the rhizomatous habit, usually greenish flowers with pink or red stain, and maroon lip. Morphologically it is most similar to *M. variabilis* Bateman ex Lindl., but the leaves of *M. costaricensis* are

usually narrower, the flowers have a different color, and in areas of sympatry the plant grows in wetter zones. The petals of *M. variabilis* are more recurved apically. In dried plants the pseudobulbs of *M. costaricensis* tend to curl, while those of sympatric *M. variabilis* tend to remain stiff. However, in Panama, plants with flowers of *M. variabilis* are seen on plants similar to those of *M. costaricensis*. For the moment these are included in *M. variabilis*, but the name, *M. chiriquensis* Schltr., may be applicable should any segregates be recognized as distinct.

Maxillaria crassifolia (Lindl.) Rchb. f., Bonplandia 2:16. 1854. *Heterotaxis crassifolia* Lindl., Edwards's Bot. Reg. 12: t. 1028. 1826. TYPE: Jamaica, *J. Lee* (holotype: κ). *Dicrypta crassifolia* (Lindl.) Lindl. ex Loud., Hort. Brit. Suppl. 3:536. 1839. *Epidendrum sessile* Sw., Prodr. Ind. Occ. 122. 1788. TYPE: Jamaica (holotype: BM, not seen). *Maxillaria sessilis* (Sw.) Fawc. & Rendle, Fl. Jamaica 1:120. 1910. Not *Maxillaria sessilis* Lindl. 1845. *Dicrypta baueri* Lindl., Gen. Sp. Orch. t. 44. 1830. TYPE: Jamaica. Figure 17B.

Plant a caespitose epiphyte, sometimes forming large clumps; pseudobulbs essentially obsolete. Roots to 2 mm in diameter. **Leaves** 4–5 per shoot, fleshy, shortly petiolate at the base, conduplicate, the blade linear to very narrowly elliptic, unequally bilobed at the apex, somewhat carinate abaxially and canaliculate adaxially on the midvein, 7–27 cm long, 1.3–3 cm wide, the adaxial surface appearing somewhat sunken along major veins. **Inflorescences** 1–few single-flowered scapes per leaf (rhizome bract) axil produced successively; ovary with pedicel about 1.5 cm long. **Flowers** barely emerging from the leaf axil, autogamous in some populations (Florida), white to yellow, the lip laterally stained or spotted with purple and with yellow callus. **Sepals** elliptic to ovate, thickened apically, 13–15(20?) mm long, 4–6 mm wide, acute. **Petals** oblanceolate to spatulate, 11–14 mm long, 3–4 mm wide, subobtusate. **Lip** articulate with the column foot, constricted below, the apical $\frac{1}{2}$ appearing somewhat 3-lobate, the sides inflexed toward the column, 12–15 mm long, 5–6 mm wide; callus farinose (mealy), sticky, extending from the base to near the apex, linear, interrupted above the middle and broadened above. **Column** lightly arcuate, cylindric, broadened above, 9–10 mm long, forming a poorly defined foot 1–2 mm long.

An epiphyte of larger branches and trunks of trees in primary or secondary wet forests, rarely on rocks or embankments, at 5–1300 m. Flowering throughout the year. Widespread throughout the neotropics; Central America, tropical South America, Jamaica, Cuba, and south Florida.

This widespread, lowland species is easily distinguished by the fleshy, conspicuously veined leaves produced in fans and by the erect, upward-facing flowers. Schlechter's *M. gatunensis* (Repert. Spec. Nov. Regni Veg. Beih. 17:68. 1922) is usually interpreted as a rather robust example from Panama with sepals 2 cm long, but the relatively short callus indicated in his floral diagnosis may be inaccurate. He probably did not observe the continuation of the callus to the lip apex, where it is less conspicuous in dried specimens.

Maxillaria cryptobulbon Carnevali & J. T. Atwood, Novon 1:159–162. 1991. TYPE: Ecuador, Morona-Santiago, Serranía de Cutucú, *Ackerman 1041*, based on *Madison s.n.* (holotype: SEL). Figure 20D.

Plant a caespitose epiphyte 30–50 cm tall. Roots to 1 mm in diameter. **Pseudobulbs** ellipsoid to suborbicular to oblong, somewhat depressed, 8–12 mm long, 9–15 mm wide, concealed by 2–3 subtending, broad sheaths, the uppermost of which may bear a blade, the apex 1-foliate. **Leaves** long petiolate; petiole (4)8–15(24) cm long, $\frac{1}{2}$ – $\frac{2}{3}$ the blade length; blades broadly elliptic, somewhat decurved, (20)25–35(42) cm long, (2.3)4.5–7 cm wide, acute, the abaxial surface often glaucous. **Inflorescences** 1–3 per shoot, borne in the flush of new growth; scapes 5–10 cm long; ovary with pedicel 3–3.3 cm long mostly or entirely concealed by the floral bract. **Flowers** spreading; sepals dull red-brown to maroon-red; petals pink or yellow-orange within, tinged with red-brown without; lip creamy yellow with yellow callus. **Sepals** similar, oblong to somewhat lanceolate, 2.6–2.8 cm long, 6–7.5 mm wide, the apex obtuse to rounded; dorsal concave; laterals somewhat oblique. **Petals** obliquely oblong-lanceolate to elliptic, 2.2–2.5 cm long, 5–6 mm wide, apex acute to obtuse. **Lip** sparsely pubescent within, ovate in general outline when spread, 1.6–1.8 cm long, 8–9 mm wide, base cuneate, 3-lobate in the apical $\frac{1}{4}$; lateral lobes erect around the column with erose, rounded, or subtruncate apices; midlobe ovate, obtuse, thickened and fleshy, abaxially keeled, the margins thin and undulate; callus a thickened ligule, rounded in front just above the middle. **Column** arcuate, 7–8 mm long excluding the anther; foot 4–4.5 mm long; anther 2.5–3 mm long, keeled dorsally.

Epiphytic in premontane rain or cloud forests at 1200–1400 m. Flowering at least June and July. Costa Rica, Ecuador, and Venezuela (450 m).

The broad, long petiolate leaves and small, depressed pseudobulb distinguish the species. It is most similar to *M. brunnea* Lind. & Rchb. f. but has much broader leaves and smaller compressed pseudobulbs, and the flowers are stained with darker red.

Maxillaria ctenostachya Rchb. f., Gard. Chron. 39. 1870. Costa Rica, *Veitch* (holotype: w). *Camaridium ctenostachys* (Rchb. f.) Schltr.; Feddes Repert. Spec. Nov. Regni Veg. Beih. 19: 238. 1923. ?*Camaridium arachnites* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:73–74. 1922. TYPE: Panama, Chiriquí, *Powell 210* (isotypes (5 sheets): AMES). Figure 8B.

Plant a somewhat straggly, cane-forming epiphyte to about 1 m tall; shoots of each cane to 20 cm long, each terminated by a pseudobulb, diminishing in size in successive shoots. **Pseudobulbs** ovoid to conic, 1.5–10 cm long, subtended by 1 or more foliaceous sheaths; apex 2-foliate. **Leaves** linear-lanceolate, obtuse, to 25 cm long, 1–1.2 cm wide, apiculate. **Inflorescences** forming in the flush of immature growth, 1(–more?) per axil of the rhizome bracts; scape to about 3 cm long; ovary with pedicel about 5–7 mm long, subtended and exceeded by an attenuate bract 1.5–1.7 cm long. **Flowers** white, sometimes striped or suffused with purple, campanulate. **Sepals** similar, attenuate, more than 2 cm long, 3 mm wide. **Petals** similar to the sepals, attenuate, 1.7–2 cm (probably more) long, about 2.5 mm wide. **Lip** hinged to the column foot, ovate, about 7 mm long and 5 mm wide when spread, 3-lobate on the upper $\frac{1}{3}$; lateral lobes obtuse and exceeding the callus; midlobe recurved, ovate; callus complex, consisting of 5 sharp keels from the base to about the middle, the outer of which terminate as sharp teeth, and a fleshy rounded callus near the divergence of the lateral lobes. **Column** 5–6 mm long excluding the anther; foot about 2 mm long.

Epiphytic in cloud forests at 900–1220 m. Flowering at least September and October. Costa Rica and Panama.

The spidery flowers borne on long canes with apically 2-foliate pseudobulbs are unique in Costa Rica. *Maxillaria ctenostachya* is poorly known and seldom collected.

Maxillaria dendrobioides (Schltr.) L. O. Williams, Ann. Missouri Bot. Gard. 27:283. 1940. *Camaridium dendrobioides* Schltr., Beih. Bot. Centralb. 36:415. 1918. TYPE: Costa Rica, San Ramón, 1500–1600 m, *Tonduz 17620* (holotype: CR). *Camaridium jimenezii* Schltr., Beih. Bot. Centralb. 36:416. 1918. TYPE: Costa Rica, La Palma, *Wercklé 855* (holotype: CR). ?*Camaridium simile* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 239. 1923. TYPE: Costa Rica, San Ramón, 1025 m, *Brenes (VII) 64* (isotype: NY). Figure 3C.

Plant a shrubby epiphyte to about 40 cm tall on usually large branches; rhizomes forming indeterminate canes, entirely concealed by sheaths, strict when small, decumbent when large; sometimes with a few branches diverging at acute angles with the main stem. Roots fibrous, white, mostly forming at the base of the plant and infrequently on the canes, rarely to 1 mm in diameter.

Pseudobulbs absent (juveniles?). **Leaves** densely distichous; sheath orangish to greenish and spotted with purple in dried material, with hyaline margins; blade coriaceous, 1–6 cm long, 5–10 mm wide, elliptic when short, lanceolate when long, the base clasping the stem, the apex unequally 2-lobate. **Inflorescence** single per leaf axil, mostly concealed by subulate bracts; scapes 1–2.5 cm long; ovary and pedicel 4–5 mm long, exceeded by the subtending floral bract. **Flowers** yellow to greenish, shading to red or salmon, the segments not spreading broadly. **Sepals** 8–13 mm long, 2–3.5 mm wide; dorsal elliptic-lanceolate, acute; lateral sepals falcate-lanceolate and acute. **Petals** elliptic to oblanceolate or obovate, 6.5–12 mm long, 2–3 mm wide, acute. **Lip** 3-lobate to broadly pandurate in outline, 4–7 mm long, 2.5–3 mm wide, obtuse; callus a fleshy ligule on the lower ½, truncate to rounded. **Column** 3–3.5 mm long excluding the anther; foot 1–2 mm long. **Capsule** globose, less than 1 cm long.

Epiphytic and common on larger branches of trees in cloud forests at 800–2400 m. Often seen on remnants in pastures. Flowering year around. Costa Rica and western Panama.

As represented by the composite description above, *M. dendrobioides* is probably a complex of species. *Maxillaria dendrobioides* (*sensu stricto*) has a distinctly three-lobed lip with the mid-lobe more or less ligulate in shape. Plants with more or less pandurate lip, i.e., the base and apex each with a pair of angled lateral lobes and shorter leaves have been segregated as *Camaridium simile*. *Camaridium jimenezii* is supposed to have the lip apex constricted, but this feature was not observed in any of the specimens examined and is probably an artifact. Vegetatively, *M. valerioi* Ames & C. Schweinf. is identical with the complex but has crystalline white flowers with a distinctly spatulate lip.

Maxillaria dichotoma (Schltr.) L. O. Williams, Bot. Mus. Leaff. 9:15. 1940. *Camaridium dichotomum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 8:98. 1921. TYPE: Pincincha, in regione subtropica vallis Nanegal, *Sodiño 94* (not found). *Maxillaria paleata* of authors. Not (Rchb. f.) Ames & Correll. Figure 14B.

Plant a straggly, pendent or decumbent epiphyte to about 1 m tall comprised of several successive shoots anchored only at the base; each shoot to 18 cm long, terminated by a pseudobulb. Roots white, to less than 1 mm in diameter. **Pseudobulbs** ovoid, compressed, 1.5–4 cm long, 1–2.5 cm wide, subtended when young by 1–3 foliaceous sheaths; apex 1-foliate. **Leaves** both apical and along the rhizome; foliate bracts broad, narrowing abruptly above the articulation to form a slender petiole; apical leaf petiolate; all blades elliptic, 2.5–20 cm long, 1.5–5 cm wide, acute or acuminate. **Inflores-**

cence short, lateral, single flowered, produced precociously on the canes of developing shoots; scapes to about 1.5 cm long, concealed by rhizome bracts; ovary with pedicel 7–9 mm long, subtended by a cucullate, acute or subulate floral bract 1.3–2.1 cm long. **Flowers** variable in color, mostly yellow or less often white tinged with purple or pink. **Sepals** similar; dorsal elliptic, 1.4–1.7 cm long, about 5.5 mm wide, acute; lateral sepals obliquely ovate-lanceolate, 1.4–1.8 cm long, about 6 mm wide. **Petals** elliptic, 1.3–1.6 cm long, 3.5–5.5 mm wide. **Lip** hinged to the column foot, 3-lobate below the middle, strongly arched, 8–10 mm long, about 5 mm wide with side lobes spread; midlobe fleshy, ovate; callus fleshy at the base terminating at the sinuses. **Column** stout, 4–5 mm long excluding anther; foot about 3 mm long; anther about 2 mm in diameter.

Epiphytic on the larger branches and trunks of trees in premontane and lower montane evergreen forests at 500–1700 m. Flowering at least August to April and probably throughout the year. Costa Rica and Panama to Colombia, Ecuador, and Peru; doubtfully in Nicaragua as reported.

This little-known species has the broadest range among its relatives, *M. minor* (Schltr.) L. O. Williams, *M. paleata* (Rchb. f.) Ames & Correll, *M. schlechteriana* J. T. Atwood, *M. sigmoidea* (C. Schweinf.) Ames & Correll, and *M. vaginalis* Rchb. f.

Maxillaria diuturna Ames & C. Schweinf., Sched. Orch. 8:58. 1925. TYPE: Panama, C. W. Powell 376 (holotype: AMES). Figure 16B.

Plant a straggly, usually pendent epiphyte with successively borne shoots developing 3–10 cm apart, with only the lowermost shoots forming roots. Roots white, rather large, to 1.5 mm in diameter. **Pseudobulbs** compressed and sharp edged, 2–3.5 cm long and 1.5–2.5 cm wide, apically truncate to emarginate 1-foliate, sheathed at the base with 2–4 leaf-bearing sheaths. **Leaves** shortly petiolate, elliptic-oblong, acute to obtuse, rarely rounded, the apical leaf 5.5–12 cm long and 1.5–3.5 cm wide. **Inflorescences** appearing singly within each rhizome bract of the immature shoot, to about 4 cm long, covered by few bracts below the ovary but mostly hidden from view by the rhizome bracts; ovary with pedicel much longer than the subtending floral bract, 2–2.5 cm long. **Flowers** clear yellow to greenish yellow, the lip sometimes red at the base and the column with a few red spots on the lower side. **Sepals** similar, 1.4–1.5 cm long, 6–7 mm wide, acute; dorsal ovate-lanceolate; lateral sepals obliquely ovate, forming a mentum at the column base. **Petals** ovate, 1.1–1.2 cm long and 5–7 mm wide, acute to obtuse. **Lip** hinged to the column foot, ovate-pandurate, vaguely 3-lobulate, apically rounded and constricted at about the apical ¼, 10–12 mm long, 5–6 mm wide; callus narrowly ovate and obtuse, fleshy, lightly 3-ridged on the lower ½. **Column** arcuate, to 8 mm long including the 3-mm foot. **Capsule** ellipsoid to 2.5 cm long.

Fairly common epiphytic or rarely terrestrial herb in rain forests at 50–1000(1600?) m. Flowering throughout the year. Nicaragua to Panama and probably Colombia.

The ascending shoots rooted only at the base of the plant and sharp-edged, apically truncate to emarginate, 1-foliate pseudobulbs are unique features among Central American maxillarias. It is perhaps most closely related to *M. nagelii* L. O. Williams, a species from Mexico.

Maxillaria dressleriana Carnevali & J. T. Atwood, *Lindleyana* 11:29–31. 1996. TYPE: Panama, Chiriquí, flowered in cultivation at the Marie Selby Botanical Gardens, 3 Jan. 1995, *Carnevali* 3858 (holotype: SEL; isotypes: AMES, INB, MO). Figure 21D.

Plant a caespitose, epiphytic herb 25–30 cm tall. Rhizome short, clothed by scariosus sheaths. **Pseudobulbs** dull dark green, tinged with dull dark maroon basally in older pseudobulbs, clustered, 2.5–4 cm tall, 1–1.5 cm wide and thick, ovoid or ovoid-ellipsoid to somewhat conic; subtended by nonfoliate sheaths; apex 1-foliate. **Leaves** erect on the pseudobulb, coriaceous, elliptic or rarely ovate-elliptic, 24–27 cm long, 2–3 cm wide, petiolate, acute. **Inflorescence** erect, shorter than pseudobulb; scape 8–12 mm long, terete; ovary with pedicel 1.4–1.9 cm long, subtended by a floral bract 1.7–2.1 cm long, 1.1–1.5 mm wide. **Flowers** deep dull red-maroon, petals paler with a yellowish cast, lip dark red-maroon, apex dull deep yellow, column dull pale cream-yellow. **Sepals** somewhat fleshy; dorsal slightly concave and subparallel to the column, oblong-elliptic, 1.5–1.6 cm long, 6.5–7 mm wide; apex obtuse-rounded; margins somewhat revolute; lateral sepals widely spreading, somewhat oblique, 1.5–1.7 cm long, 5–6 mm wide; apex obtuse or obtuse-rounded; margins revolute. **Petals** subparallel to column, narrowly obovate or narrowly obovate-oblong, 1.4–1.5 cm long, 4.55 mm wide; apex acute or obtuse-rounded; margins somewhat revolute. **Lip** 3-lobate, 1.4–1.6 cm long, 7.5–8.5 mm wide when expanded; lateral lobes falcate-uncinate, acute, emerging just below the middle portion of the lip, 1–1.5 mm long, ca. 1 mm wide at base; midlobe subquadrate-oblong or subquadrate-pandurate, somewhat broadened apically, 7.5–9 mm long, 4.5–5.5 mm wide; apex subtruncate, shallowly emarginate; disc with a farinose yellow callus reaching midlength of the midlobe. **Column** arcuate, broadly winged apically, 8–10 mm long, 4–5 mm wide; column foot 4–5 mm long; anther smooth.

Poorly known ecologically; 80 m. Flowering November. Endemic to Costa Rica and western Panama.

Within the *M. rufescens* Lindl. complex in Costa Rica, the dull, dark maroon flowers are unique.

Maxillaria elatior (Rchb. f.) Rchb. f., *Ann. Bot. Syst.* 6:532. 1863. *Dicrypta elatior* Rchb. f.,

Linnaea 18:403. 1844. TYPE: Guatemala, Quezaltenango, *Leibold* 14 (not seen). ?*Camariidium xylobiichilum* Kraenzl., *Vidensk. Medd. Nat. Copenhagen* 71:174. 1920. TYPE: Locality unknown (drawing of type: AMES). *Maxillaria triangularis* Lindl., *Edwards's Bot. Reg.* 31: Misc., p. 9. 1845. TYPE: Guatemala *Hartweg s.n.* (holotype: K). *Maxillaria albertii* Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 19: 229. 1923. TYPE: Costa Rica, Alajuela, Rio Jesus de San Ramon, *Brenes* 257 (lectotype: CR; isolectotype: AMES). Figure 7F.

Plant large to 1 m tall, forming conspicuous canes, straggly, pendent when large; shoots comprising each cane forming 2–10 cm apart. Roots white, large, to 2 mm in diameter. **Pseudobulbs** subtended by 1–several leaf-bearing rhizome bracts, apically 1–2-foliate, ovate, smooth, compressed, 4–8 cm long, 2–3 cm wide. **Leaves** petiolate, the blade coriaceous, 5–30 cm long, 2–4 cm wide. **Inflorescence** 1 per rhizome bract axil of immature shoots, to about 5 cm long, excluding the pedicel and ovary, covered by 3 or more acute, imbricating sheaths; ovary with pedicel 3.2–5 cm long, far exceeding the subtending floral bract. **Flowers** orange to red or greenish yellow flushed with red. **Sepals** ovate-lanceolate, 2–2.6 cm long, 7–10 mm wide, acute; lateral somewhat oblique. **Petals** falcate-lanceolate, about 1.8–2.2 cm long, 4–5.5 mm wide. **Lip** simple when spread, elliptic-ovate, slightly 3-lobulate just below the apical 1/3, about 1.7 cm long and 9–10 mm wide, the sides somewhat infolded around the column; apex tapering, somewhat obtuse, recurved; callus a broad, thickened, biblike ligule on lower 1/2–2/3, rounded to slightly V-shaped in front. **Column** arcuate, about 1.2 cm excluding the anther; foot 3–4 mm long; pollinia 4, supported on a saddle-shaped viscidium and a short, squarrose stipe. **Capsule** ellipsoid, 4–5 cm long.

Epiphytic on larger branches of evergreen forests, apparently tolerant of various elevations (400–1500 m). Flowering September to April. Mexico to Costa Rica.

The type of *Dicrypta elatior* Rchb. f. (*Leibold* 14) was not found, but a specimen so labeled in Reichenbach's handwriting (*Leibold* 44) indicates that the collection number may have been misprinted.

Costa Rican *M. elatior* was originally described as *M. albertii* by Schlechter, who compared it with *M. houtteana* Lindl., not *M. elatior*. Over the whole range, pseudobulbs may have one or two apical leaves, and specimens from Belize show the short rhizomes between pseudobulbs as seen in Costa Rica. The only remaining difference between Costa Rican plants and those to the north seems to be the tendency for narrower leaves in Costa Rica.

Maxillaria endresii Rehb. f., Gard. Chron. n.s. 26:680. 1886. TYPE: Costa Rica, *Edward Low* s.n. (holotype: w). Figure 20B.

Plant a densely caespitose epiphyte forming large clumps. Roots white, large to 2 mm in diameter. **Pseudobulbs** sessile, 3.5–6 cm long and 2.5–4 cm wide, shiny but strongly ridged in the dried specimen, compressed, ovoid to orbicular, and apically obtuse, truncate or emarginate, 1-foliate, subtended and covered when young by a pair of acute sheaths to 7 cm long. **Leaves** large, the long petiole to $\frac{1}{2}$ the blade length; blade elliptic-oblong, 15–35 cm long and 4–7 cm wide, acute to obtuse. **Inflorescence** to about 15 cm, 1-flowered per rhizome bract forming on mature shoots, sheathed by 4–7 bracts; ovary with pedicel 2.5–3 cm long. **Flowers** strongly scented, variable in floral segment attenuation, the perianth yellow within, lighter on the abaxial side, the lip bright yellow with a white margin, the lateral lobes striped with purple. **Sepals** similar, acute; dorsal oblong, erect 5.5–7 cm long, 9 mm wide, the lateral sepals lanceolate, falcate, 5.5–8 cm long, 1 cm wide. **Petals** light yellow, smaller than the sepals, broadened at the base, linear-lanceolate, 4.5–6.5 cm long, 7 mm wide, attenuate. **Lip** abruptly 3-lobate at the middle, puberulent centrally, 2.5–3 cm long, 1.2 cm wide, the rather narrow lateral lobes overlapping the large, orbicular, recurved midlobe; callus simple, extending to just below the middle, more or less V-shaped in front. **Column** white, lined with purple, cylindric, somewhat arcuate, 2 cm long including the 8-mm-long foot; anther bed magenta, coarsely ciliate; anther cap brownish, 3 mm long. **Capsule** ellipsoid, to 3 cm long.

Epiphyte of larger trunks in evergreen primary forests at 50–700 m. Flowering March to May and September. Nicaragua to Panama; possibly into South America, where specimens may be misidentified as *M. luteoalba* Lindl.

The truncate, rounded pseudobulbs with large leaves supported on long petioles and large, fragrant flowers with attenuate floral segments are good features for field recognition.

Maxillaria endresii has been confused with the South American *M. luteoalba* Lindl., which has a lip with broader side lobes and a nonorbicular pseudobulb. It is also similar to *M. angustisegmenta* Ames, Hubbard & C. Schweinf., a higher elevation species from Costa Rica and Panama with subconic pseudobulbs, shorter perianth segments, and broader side lobes.

Maxillaria exaltata (Kraenzl.) C. Schweinf., Bot. Mus. Leaf. 11:272. 1945. *Camaridium exaltatum* Kraenzl., Bot. Jahrb. Syst. 37:386–387. 1906. TYPE: Peru: Department of Loreto, mountains east of Moyobamba, *Weberbauer* 4620 (photo of type: AMES). Figure 6C.

Plant a somewhat straggly epiphyte to about 2 m tall, forming upright or decumbent canes to about 1 cm in diameter, concealed by rugose sheaths. Roots to about 1 mm in diameter. **Pseudobulbs** reduced to slight swelling near the stem apex or essentially absent. **Leaves** subcoriaceous, linear-lanceolate, increasing in size near the stem apex, to about 20 cm long and 2.5 cm wide, acute. **Inflorescences** several per leaf axil, the peduncles about 5 cm long and concealed by bracts; ovary with pedicel 1.5–1.8 cm long, exceeded by the subtending somewhat inflated floral bract. **Flowers** white or cream, lip pink to red-violet with yellow midlobe; segments not broadly expanded. **Sepals** dissimilar, the dorsal oblong, 1.8–2 cm long, 5–6 mm wide, acute; lateral sepals obliquely inserted on the column foot, oblong to triangular, 2.2–2.4 cm long, about 5 mm wide, acute. **Petals** oblong, somewhat falcate, oblique at the base, 1.6–1.8 cm long, 3–3.5 mm wide, acute. **Lip** somewhat obovate when spread, 1.2–1.4 cm long, 5.5–6.6 mm wide, 3-lobate on the apical $\frac{1}{4}$; side lobes somewhat clasping the column; midlobe fleshy, verrucose, bluntly acute to obtuse, about 2.5 mm long and wide. **Column** 6–7 mm long excluding the anther; foot 7–7.5 mm long; anther verrucose, 2.5 mm long.

Epiphytic in cloud forests at 650–1500 m. Flowering in Central America September to March and July. Peru (type) to Costa Rica.

Maxillaria exaltata is a member of the *M. meridensis* Lindl. complex, characterized by the upright canes, which are somewhat swollen terminally and concealed by rugose sheaths. This species differs from *M. meridensis* by the much larger plant size and by the lip, which has a nearly orbicular midlobe. It is also a species of lower elevations, and *M. meridensis* flowers March to August (December). Both species have been seen growing within a few meters of one another at Tapantí.

Maxillaria falcata Ames & Correll, Bot. Mus.

Leaf. 11:15. 1943. *Ornithidium costaricense* Schltr., Repert. Spec. Nov. Regni Veg. 8:456. 1910. TYPE: Costa Rica, *Pittier* (Tonduz?) 2177 (lectotype selected here: AMES 24213). Not *Maxillaria costaricensis* Schltr. Figure 7C.

Plant an erect to decumbent epiphyte or terrestrial to about 1 m high, lacking pseudobulbs (juveniles?); canes monopodial, erect, branched, sometimes fasciculately so, concealed by leaf sheaths. Roots to about 1 mm in diameter. **Leaves** usually deciduous along the lower cane, with rugose sheaths; blade above the articulation thin, conduplicate, oblong-lanceolate, abaxially keeled, 3.5–16 cm long, 7–23 mm wide, the apex unequally 2-lobate. **Inflorescences** 2 or more per leaf axil, shorter than the subtending leaf; scape about 3 cm long; ovary with pedicel 1–1.2 cm long, subtended by a somewhat cucullate floral bract to about 1.7 cm long and with hyaline margins. **Flowers** white or pinkish. **Sepals** similar, oblong, 1.8–2.4 cm long, 4–5.5 mm wide, acute. **Petals** elliptic-

oblanceolate to somewhat falcate and attenuate, 1.7–2.4 cm long, 5–6 mm wide. **Lip** rigidly attached to the column, 3-lobate on the apical $\frac{1}{4}$ – $\frac{1}{3}$, 5.5–6.5 mm long, about 4 mm across the lateral lobes when spread; lateral lobes falcate, rounded, longer than the subacute, subovate midlobe; callus from the base to above the middle, low and lamellate at the base, high and 3-keeled in front. **Column** longer than the lip, cylindric, slightly arcuate, 7.5–8 mm long excluding the anther; foot about 1 mm long.

Epiphytic or terrestrial on steep embankments at 1800–2400 m. Flowering February and March. Costa Rica and Panama.

This species is easily distinguished from similar ones by the relatively large lateral lobes of the lip, which are exceeded by the column. Lips are often lacking, probably having been eaten by insects.

The drawing at AMES of *Ornithidium costaricense* is labeled as based on Tonduz 2177, not Pittier 2177. A notebook at US includes the collections of both Tonduz and Pittieri (and Biolley) within the same institutional numbering system; therefore, the confusion is understandable. The original Latin description agrees well with the drawing, which is all that has been found of the original materials.

Maxillaria flava Ames, Hubbard & C. Schweinf., Bot. Mus. Leaflet 3:41. 1934. *Ornithidium ramonense* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:243–244. 1923. TYPE: Costa Rica, San Pedro de San Ramón, Brenes 137 (photograph of type: AMES). Not *Maxillaria ramonensis* Schltr. Figure 12D.

Plant an erect or pendent, cane-forming epiphyte to about 30 cm tall, rooted only on the lower shoots; stems much elongate, to about 7 cm long between pseudobulbs in the lower shoots, diminishing in successive shoots. Roots to about 1 mm in diameter. **Pseudobulbs** conic and rather truncate, clearly and regularly furrowed in dried specimens, 1–3 cm long, subtended by 1–2 foliate sheaths, the apex 1-foliate. **Leaves** similar, those subtending the pseudobulb with sheath; apical leaf without petiole; blades thin, elliptic, 1–7 cm long, 4–14 mm wide, rounded to emarginate, abaxially keeled. **Inflorescence** 1 per rhizome bract of both mature and immature shoots; 8–20 mm long; ovary with pedicel 5–8 mm long, somewhat exceeded by the subtending acute, floral bract. **Flowers** not opening widely or with sepals and petals recurved, greenish yellow. **Sepals** subequal, elliptic-lanceolate, 9–12 mm long, 1.5–2.5 mm wide; laterals subfalcate. **Petals** elliptic-lanceolate, 7.5–10 mm long, 2–2.5 mm wide, acute. **Lip** hinged with the column foot, convex, ovate when spread, 3–4.5 mm long, about 2 mm wide, 3-lobate on the lower quarter, recurved in natural position; lateral lobes shorter than the callus, short and acute; midlobe ovate, rounded to emarginate; callus fleshy, rounded and somewhat elevated in front, termi-

nating below the middle. **Column** stout, arcuate, somewhat tapering, 2.5–3 mm long excluding the anther; foot about 1 mm long; anther less than 1 mm in diameter.

Epiphytic in cloud forests at 700–1350 m. Flowering October and November. Endemic to Costa Rica and Panama.

Maxillaria flava is similar to *M. microphyton* but unique in the distinctly furrowed pseudobulbs. The flowers are apparently always yellow, lacking the red stripes or suffusion seen in related species; hence the name. The short lateral lobes of the lip exceeded by the callus readily distinguishes this from *M. microphyton* Schltr.

Maxillaria friedrichsthali Rchb. f., Bot. Zeitung (Berlin) 10:858. 1852. TYPE: Guatemala, Chontales, in Monte Aragua, *Friedrichsthal* (isotype: AMES). *Maxillaria turialbae* Schltr., Beih. Bot. Centralbl. 36:414–415. 1918. TYPE: Costa Rica, Turialba, F. C. Lehmann 1098 (drawing of type: AMES). Figure 8C.

Plant a loosely straggly epiphyte, or if caespitose then formed of a cluster of successively borne shoots. Roots fibrous, white, to 1 mm in diameter. **Pseudobulbs** oblong, 1–3 cm apart, 3–5 cm tall and 6–15 mm wide, somewhat laterally flattened and with several vertical ribs more conspicuous when dried, subtended by 1–2 early deciduous blade-bearing bracts, apically 2–3-foliate. **Leaves** linear to oblong, 3.5–15 cm long and 3.5–12 mm wide, unequally 2-lobed apically. **Inflorescence** lateral, borne singly per rhizome bract axil, the peduncles 1.5–3 cm long covered by 5–7 bracts; ovary with pedicel 10–15 mm long, entirely concealed by a subtending pair of bracts, the uppermost 11–17 mm long. **Flowers** with a slight urinous odor, coriaceous, not opening fully and difficult to spread, white to yellowish, turning greenish with age, the lip often yellow centrally and flushed or rarely spotted lavender laterally. **Sepals** similar, oblong-lanceolate, concave, 15–20 mm long, 3.5–5 mm wide, acute; lateral sepals falcate, adnate to the column foot. **Petals** falcate, elliptic-oblong, 13–18 mm long, 2–3 mm wide, acute. **Lip** hinged with the column foot, elliptic oblong, very slightly 3-lobate, 12–15 mm long; callus linear, basal, extending to about the middle. **Column** 9–11 mm long, including the short foot; pollinia with long stipe, anther bed ciliate.

Epiphytic in wet forests at 50–1500 m. Flowering mostly November to March. Mexico (Campeche), Belize, and Guatemala to Panama.

This species is usually confused with *M. aciantha* Rchb. f. and *M. scorpioidea* Kraenzl. It has the smallest flowers of the three species, is the most frequently seen, and has a broader range and perhaps ecological tolerance in Central America than the other two. Schlechter moved his own species, *M. turialbae*, into synonymy with *M.*

friedrichsthali, and the floral dimensions given in his original description fit this concept exactly, not with *M. aciantha* or *M. scorpioidea*.

Maxillaria fulgens (Rchb. f.) L. O. Williams, Ann. Mo. Bot. Gard. 28:425. 1941. *Ornithidium fulgens* Rchb. f., Beitr. Orch. Centr.-Am. 76. 1866. TYPE: Costa Rica, "Naranjo," *Wendland* (holotype: w; photo of type: AMES). Figure 6A.

Plant a robust, shrublike, or cane-forming epiphyte to about 70 cm tall, with 1–several branches anchored only at the base, each branch consisting of 1 or more shoots produced successively 10–20 cm apart and terminating in a 1-foliate pseudobulb. Roots large, to 3 mm in diameter. **Pseudobulbs** to about 3 cm long, conic, subtended and hidden by 2–5 blade-bearing bracts. **Leaf** blades coriaceous, lanceolate, to narrowly elliptic, somewhat petiolate above the articulation, 9–20 cm long, 1.5–4.5 cm wide, acute. **Inflorescence** a fascicle of 2–8 single-flowered scapes produced in the bract axils of the developing vegetative bud, each scape 2–3 cm long; ovary with pedicel 11–15 mm long. **Flowers** globose, the segments not spreading widely, bright red, lip yellow. **Sepals** broadly triangular-ovate, 7 mm long, 4–4.5 mm wide, acute to obtuse. **Petals** elliptic-ovate, slightly clawed at the base, 6 mm long, 2.5–3 mm wide, acute. **Lip** rigidly attached to the column, 5 mm long in natural position, difficult to spread, constricted in the middle, saccate on the basal half, the apex deflexed. **Column** stout, 2.5 mm long; foot about 2 mm long.

Epiphyte of the larger branches in wet forests at 100–2000 m. Flowering June to December, February, April, and May. Nicaragua to Panama, and northern South America.

This species is one of the most remarkable for its paedomorphic habit of producing several flowers per bract axil of a vegetative shoot barely beyond the bud stage. The multiple flowers appear superficially to arise from rhizome bract axils of the already developed shoot.

Maxillaria gomeziana J. T. Atwood, Lindleyana 11:202–204. 1996. TYPE: Costa Rica, Province of Puntarenas, Coto Brus, 1600 m. Mar. 1995, *Atwood, C. & J. Luer ex Atwood 5052* (holotype: SEL). Figure 16D.

Plant a somewhat ascending, cane-forming epiphyte to about 30 cm tall, comprised of shoots 5–10 cm long including the pseudobulb. Roots \leq 1 mm in diameter. **Pseudobulbs** fusiform, compressed, 1-foliate, 3.5–5 cm long, 1–1.5 cm wide, subtended by 1–4 strongly rugose sheaths, the uppermost with soon deciduous blades. **Leaf** blades shortly petiolate, subcoriaceous, linear-oblong, 12–28 cm long, 1–1.5 cm wide, the apex unequally 2-lobate. **Inflorescences** 1–3 per foliaceous sheath axil;

scapes 2.5–4 cm long; ovary with pedicel 11–15 mm long, trigonous, subequal to the subtending floral bract. **Flowers** with somewhat spreading segments, pale yellowish green, lip marked with red apically and on side lobes. **Sepals** similar, oblong to oblanceolate, 1.7–2.3 cm long, 4–5 mm wide, acute; dorsal somewhat keeled dorsally and apically; lateral sepals recurved. **Petals** elliptic-oblanceolate, 1.6–1.8 cm long, 3–4 mm wide, acute. **Lip** hinged to column foot, 3-lobate below the middle, 1–1.2 cm long, 6–8 mm wide when spread; lateral lobes rounded, somewhat erect; midlobe fleshy, oblong-obovate with recurved lateral margins in natural position, rhombic when spread, rounded, abaxially keeled; callus fleshy, thickened and rounded in front, ending below sinuses between lobes, with a blunt central and 2 less distinct lateral keels. **Column** stout, somewhat arcuate, 5–6 mm with anther, 3.5–4 mm without anther, foot about 2 mm long. **Capsule** 3-winged.

Poorly known epiphyte at (200)400–1620 m. Flowering at least August, October, and February; flowering in cultivation at SEL October to December. Native to Panama and adjacent Costa Rica.

Only recently has a living plant of *M. gomeziana* been observed in flower, hence the delay in its description. It is closely related to *M. bracteata* (Schltr.) Ames & C. Schweinf., with which it shares the central keel of the callus, but has narrower leaves, more slender pseudobulbs, more slender perianth segments, and trigonous ovaries that develop into triolate capsules. (See Addendum, p. 173.)

Maxillaria haberi J. T. Atwood, Selbyana 16: 245. 1995. TYPE: Costa Rica, Province of Heredia, forest between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, 700–750 m, 4 Apr. 1986, *M. H. Grayum 6769* (holotype: CR). Figure 11E.

Plant a conspicuously rhizomatous epiphyte to at least 50 cm tall, probably pendent when large; rhizome 6–8 mm in diameter, 7–10 cm long between pseudobulbs, concealed when young by acute, nonfoliaceous bracts. Roots slender, to 1 mm in diameter. **Pseudobulbs** ovate, compressed, subtended by 1–3 leaves, 3.5–5 cm long, 1.5–2 cm wide, with 1-foliate apex. **Leaves** elliptic-oblanceolate, conspicuously petiolate, the blade 12–22 cm long, 4–6 cm wide, acute. **Inflorescence** appearing in the flush of new growth, scapes 4–5 cm long, ovary 10–13 mm long, somewhat exceeded by the subtending floral bract. **Flower** somewhat spreading, yellow to orange or tan, the lip maroon-red near base, white near apex. **Sepals** similar, elliptic-lanceolate, 3.8–4.1 cm long, 1 cm wide, acute. **Petals** oblanceolate, about 3.7 cm long, 6 mm wide, acute. **Lip** rather fleshy, obovate in general outline, 2.5 cm long, 1.8 cm wide when spread, 3-lobate on the upper $\frac{1}{2}$; lateral lobes embracing the column; midlobe subquadrate, obtuse; callus of 3 keels from the base to below the sinuses of the lateral lobes, the middle keel lower and less distinct than the

outer. **Column** slightly arcuate, 1.8–2 cm long excluding unknown anther, with a swelling on the lower $\frac{1}{3}$ ventral side.

Epiphytic at 850 m. Flowering at least April, July, and September. Endemic to Costa Rica; known only from the Peñas Blancas Valley near Monteverde.

Maxillaria haberi is known only from three collections made between 1986 and 1989: *Grayum* 6769 (CR), *Bello & Cruz* 1023 (INB), and *Haber & Cruz* 7474 (MO). Apparently a rare species; recent attempts to relocate it have failed.

It is most readily distinguished by the combination of long rhizomatous habit with 1-foliate pseudobulbs terminating each shoot, the large elliptic-oblongate leaves, and the relatively large yellow flowers. The plant appears similar to that of *M. planicola* C. Schweinf. but has foliaceous sheaths at the base of the pseudobulbs. The flowers are also large as in *M. planicola*, but the lip is proportionately longer and has a callus of three keels rather than of stiff hairs and a ligule.

Maxillaria hedwigiae Hamer & Dodson, Ic. Pl.

Trop. 8: t. 800. 1982. TYPE: Guatemala, Río Dulce, near Lake Isabal, *Hamer A 161* (holotype: SEL). Figure 21C.

Plant a caespitose epiphyte, sometimes forming large clumps. Roots large, to 2 mm in diameter. **Pseudobulbs** rugose, ovoid-conic, 1-foliate, to about 4.5 cm long and 2.5 cm wide, sheathed basally when young by 4–6 acute, nonfoliate bracts. **Leaf** thin, petiolate, the blade narrowly elliptic, to 36 cm long and 3.5 cm wide (usually smaller), acute. **Inflorescence** 3–5 cm long with 3 or 4 acute bracts about 1.5 cm long; ovary with pedicel 2.2–3 cm long, exceeding the subtending floral bract. **Flowers** white to cream or greenish, or probably turning greenish with age; lip bright orange. **Sepals** elliptic, 17–19 mm long, 7–9 mm wide. **Petals** elliptic, 15–17 mm long, 6–7 mm wide. **Lip** 3-lobate at about the middle; lateral lobes erect, lanceolate; midlobe very fleshy, somewhat lanceolate but with a truncate to retuse apex; callus spatulate, extending to about the middle. **Column** arcuate, clavate, about 9 mm long, with a short foot about 1 mm long and winged on the ventral side of the upper half. **Capsule** ellipsoid, 2 cm long.

Epiphytic at 0–650 m. Flowering (October) November to March. Locally common from (Mexico?) Guatemala to Costa Rica.

The white to greenish white or cream flowers with distinct orange lip are the best features for recognition. Also, the midlobe is usually lanceolate and more or less acute, unlike its relatives, *M. acutifolia* Lindl. and *M. moralesii* Carnevali & J. T. Atwood, which have truncate apices.

Maxillaria horichii Senghas, Orchidee (Hamburg) 28:13. 1977. Figure 3. TYPE: Costa Rica, “near Sisicá, between La Palma de San Isidro del General and Playa Dominica,” *Horich s.n.* (holotype: HEID, not seen). *Sepalosaccus horichii* (Senghas) Senghas, Orchideen 29:1745. 1994. Figure 10A.

Plant a straggly, rhizomatous epiphyte rooted only on the lower shoots; rhizome elongate, to 5(6) mm in diameter, concealed by bracts, pendent, forming shoot systems to about 50 cm long. Roots fibrous, rarely more than 1 mm in diameter. **Pseudobulbs** cylindric to ovoid, compressed, subtended by 2–3 subulate, nonfoliaceous bracts, 2–3 cm long, 1.2–2 cm wide, apically 1-foliate, spaced 3–9 cm apart on the rhizome. **Leaves** shortly petiolate; blade lanceolate, 8–19 cm long, 1.2–2.8 cm wide, acute. **Inflorescences** in fascicles borne at the base of the recently matured pseudobulb; scapes to about 1.5 cm long, mostly concealed by the rhizome bracts; ovary and pedicel about 5 mm long, concealed by inflated, ovate scape bracts. **Flowers** bright orange, column sometimes (always?) white. **Sepals** dissimilar, not opening widely; dorsal elliptic-ovate, concave, 7–9 mm long, 3–4 mm wide; lateral sepals ovate, about $\frac{3}{4}$ connate, 7.5–10 mm long, 4–5 mm wide, acute. **Petals** ligulate, 6–7 mm long, about 2 mm wide, acute. **Lip** rigidly attached to the column foot, reflexed at about the middle when viewed laterally, 5–6 mm long when straightened, the basal half canaliculate, the apical half 3-lobate; lateral lobes reduced to auricles; midlobe very bluntly V-shaped, provided with a similarly bluntly V-shaped callus at the midlobe base. **Column** stout, about 2 mm long excluding the anther; anther with a beak; pollinia 4, supported on a distinct stipe about 1 mm long and a saddle-shaped viscidium; rostellum prominent.

Epiphytic in premontane rain forests at 500–1500 m. Flowering material has been collected September to November and July. Costa Rica from the region of San Isidro del General, Province of San José to Boquete, Panama.

Maxillaria horichii is unique in the more or less urseolate red flowers resembling those of species of *Mediocalcar* from New Guinea. Although similar to *M. pseudoneglecta* (see below), the lip (especially when spread) and column are quite different. The lip of *M. horichii* is narrowly cuneate at the base with a relatively long, broadly lanceolate midlobe, and the lateral lobes are reduced to auricles. When viewed laterally, the lip appears boomerang shaped. The callus is bluntly V-shaped in front and not transversely straight and continuous with the lateral lobes as in *M. pseudoneglecta*. Although the orange-colored forms seen in *M. pseudoneglecta* suggest hybridization with *M. horichii*, available herbarium specimens reveal no flowers with intermediate morphology.

Maxillaria inaudita Rchb. f., Beitr. Orch. Centr.-Am. 76. 1866. TYPE: Costa Rica, Cartago, Wendland s.n. (holotype: w). Figure 2C.

Plant epiphytic, caespitose, as juveniles consisting of tightly clustered shoots with pseudobulbs; at maturity producing a cluster of elongate, monopodial, decumbent, leafy canes to 1 m tall. Roots large, to 2 mm in diameter. **Pseudobulbs** of juveniles ovoid, apically 1-foliate, to 5 cm long. **Leaves** coriaceous, distichous on the canes, 3–7 cm apart, shortly petiolate above the articulation, the sheaths rugose, the petiole narrowing just above the articulation, the blade 5–20 cm long, 2–5 cm wide, oblong-elliptic, often striate, the apex variable, usually rounded to obtuse, sometimes emarginate. **Inflorescences** lateral on the canes, single per leaf axil, short, rarely reaching the subtending blade apex; scapes 5–8 cm long, mostly concealed by acute sheaths and the subtending leaf sheath; ovary with pedicel 14–18 mm long, usually exceeded by the subtending inflated floral bract. **Flowers** white to light yellow, the lip darker yellow or spotted with dark yellow near the apical margin. **Sepals** elliptic to lanceolate, 3–6.5 cm long, 7–12 mm wide, acute. **Petals** narrowly elliptic, falcate, 2.5–6 cm long, 5–10 mm wide. **Lip** cuneate, apically 3-lobate, 1.5–2 cm long, 1.2–1.7 cm wide when spread; callus 3-carinate to just above the middle. **Column** arcuate, 1.2–1.5 cm long including the short foot; pollinia 4, supported on short, squarrose stipe with viscidium. **Capsule** narrowly ob-ovoid, 5–6 cm long.

Epiphytic in cloud forests at 800–1800 m. Flowering throughout the year in Costa Rica; January to June in Panama. Costa Rica and Panama.

Sometimes confused with the much smaller-flowered *M. trilobata* Ames & C. Schweinf., *M. inaudita* is easy to recognize by the large light yellow to white flowers. *Maxillaria inaudita* var. *minor* Ames & C. Schweinf. is described as having flowers about half the size of those of typical *M. inaudita*, and most of the available samples from Panama show this smaller tendency. Most herbarium specimens include only upper stem portions lacking pseudobulbs, which probably explains why Reichenbach's description indicates that the species lack pseudobulbs. Approximate shoots with apically 1-foliate, ovoid pseudobulbs do develop in juveniles, and the mature canes develop from these. Juveniles appear very different from the adults.

Maxillaria lankesteri Ames, Sched. Orch. 7:11–12. 1924. TYPE: Costa Rica, Lankester 508 (holotype: AMES). *Ornithidium aurantiacum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 241. 1923. Costa Rica, San Pedro de San Ramón, Brenes 129 (drawing of type: AMES). Not

Maxillaria aurantiaca A. Rich. & Gal. Figure 13B.

Plant a somewhat straggly epiphyte to 20 cm tall; rhizome erect or decumbent, rooted mostly at the base; rhizome segments to about 8 cm long between pseudobulbs. Roots to 0.5 mm in diameter. **Pseudobulbs** cylindrical to somewhat tapered, 1–3 cm long, about 7 mm wide at the base; subtended by 1–2-foliate sheaths; apex 1-foliate. **Leaves** coriaceous to fleshy, sessile, elliptic, 1–3.5 cm long, 7–13 mm wide, with unequally 2-lobate apex. **Inflorescence** 1 per rhizome bract axil of the developing shoot; scape to about 1.5 cm long; ovary with pedicel 7 mm long, nearly concealed by the subtending floral bract. **Flowers** translucent tan with maroon stripes. **Sepals** similar, elliptic to oblong-lanceolate, 1.2–1.4 cm long, 3–3.5 mm wide, acute; laterals inserted on the column foot. **Petals** elliptic-lanceolate, about 11 mm long, 3 mm wide, acute. **Lip** hinged to the column foot, elliptic-ovate in general outline, 9–9.5 mm long, 3.5 mm wide in natural position, 5.5 mm wide when spread, 3-lobate at the base; lateral lobes short, not exceeding $\frac{1}{5}$ the lip; midlobe elliptic, obtuse, the side margins much recurved; callus tongue-like, exceeding and connecting the lateral lobes. **Column** stout, 2–3 mm long excluding the anther; foot about 2 mm long; anther about 1.5 mm in diameter.

Maxillaria lankesteri is a poorly collected epiphyte in premontane rain forests at 600–1500 (1900?) m. Flowering July to February. Costa Rica and western Panama.

It appears to be uncommon, because few duplicate specimens are available. It has been considered as a synonym of *M. wercklei* (Schltr.) L. O. Williams, a species with somewhat smaller shoots and flowers nearly identical in morphology but much smaller in size.

Maxillaria linearifolia Ames & C. Schweinf., Sched. Orch. 10:95–96. 1930. TYPE: Costa Rica, San Ramon, A. M. Brenes (19) 314 (holotype: AMES). Figure 3A.

Plant a straggly, somewhat vinelike, essentially monopodial, pendent or decumbent epiphyte forming wiry, sparsely branched canes to about 4 mm in diameter. Roots white to grayish, to 0.5 mm in diameter. **Pseudobulbs** lacking, stems covered by leaf sheaths. **Leaf** blades narrowly lanceolate, coriaceous, shiny, 2–10 cm long, 3–8 mm wide, acute. **Inflorescence** single per leaf axil; scape about 1.5–2 cm long; ovary with pedicel 3–3.5 cm long, far exceeding the subtending floral bract. **Flowers** white or cream marked with purple spots, the lip purple or spotted with purple. **Sepals** narrowly ovate, 13–14 mm long, 4 mm wide, acute; dorsal somewhat concave. **Petals** lanceolate, falcate, 12 mm long, 3 mm wide. **Lip** hinged to the column foot, cuneate, 11–12 mm long, 3–4 mm wide, shallowly 3-lobate on the upper $\frac{1}{2}$; midlobe somewhat broadened above, broadly rounded at the apex. **Column** arcuate, much broadened above,

8 mm long, extended into a foot 3 mm long at the base. **Capsule** ellipsoid, 2.5–3 cm long.

An epiphyte of larger branches, grasslike, sometimes forming large, hanging masses at 1200–1700 m. Flowering September to February and July. Costa Rica and Panama.

In Costa Rica, *M. linearifolia* is most similar to *M. appendiculoides* C. Schweinf. but differs in the distinctly lanceolate, not elliptic, leaves. It is similar to the South American *M. graminifolia* (Kunth) Rchb. f. and may prove to be conspecific.

Maxillaria longiloba (Ames & C. Schweinf.) J. T. Atwood, Ic. Pl. Trop. 16: t. 1562. 1993. Basionym: *Maxillaria brenesii* Schltr. var. *longiloba* Ames & C. Schweinf., Sched. Orch. 10:90–91. 1930. TYPE: Costa Rica, Province of Heredia, Yerba Buena, northeast of San Isidro. Standley & Valerio 49104 (holotype: AMES; isotype: US). Figure 19D.

Plant a caespitose epiphyte, sometimes forming large clumps. Roots about 1 mm in diameter. **Pseudobulbs** not much flattened laterally, conic-ovoid, 2.5–4 cm long, 1.5–2 cm wide, hidden by short, subulate nonfoliaceous sheaths fraying with age, apically 1-foliate. **Leaf** petiolate, the blade coriaceous, keeled beneath, narrowly elliptic, 17–27 cm long, 2.5–4.5 cm wide, acute. **Inflorescences** 2 or more per bract axil at the base of the pseudobulb, produced successively; scape 8–25 cm long, mostly concealed by 4–7 acute sheaths; ovary and pedicel 2.5–4 cm long, subtended by a usually somewhat shorter, acute, laterally flattened floral bract. **Flowers** fragrant, not spreading widely, greenish yellow, the lip usually black-purple. **Sepals** similar, somewhat concave, oblong-lanceolate, acute; dorsal 2.2–2.5 cm long, about 7 mm wide; lateral sepals adnate to the column foot, 2.4–2.7 cm long, about 8 mm wide. **Petals** linear-lanceolate, 2–2.2 cm long, 4 mm wide, acute. **Lip** articulate to the column foot, parallel with the column, about 1.5 cm long, 1.5 cm wide when spread, 3-lobate; side lobes more or less truncate apically with involute margins forming a canalliculate lip base; midlobe strongly reflexed to about 90°, exceedingly fleshy and terete, warty, the margins somewhat revolute; callus a fleshy plate, apparently pubescent (difficult to see in some herbarium specimens). **Column** stout, arcuate, 7–10 mm long including the anther; column foot 2–3 mm long; pollinia 4, supported on a saddle-shaped viscidium. **Capsule** about 6 cm long.

Epiphytic in cloud forests at 1100–2000 m; probably restricted to the dryer areas of rain shadows. Flowering October to March. Costa Rica and Panama.

Maxillaria longiloba is readily distinguished from *M. brunnea* Lind. & Rchb. f. by flower color and the sharply reflexed midlobe of the lip. No

hybrids have been seen in Monteverde, where both species may be seen growing together.

Maxillaria longipetiolata Ames & C. Schweinf., Sched. Orch. 8:61–62. 1925. TYPE: Panama, hill east of Corozal, Powell 307 (holotype: AMES). Figure 19A.

Plant a caespitose epiphyte 15–35 cm tall. Roots grayish, to 1.5 mm in diameter. **Pseudobulbs** ovoid, to 3 cm long, 1-foliate. **Leaves** with distinct petiole more than $\frac{1}{4}$ the blade; blade narrowly elliptic to linear, chartaceous to subcoriaceous, 15–27 cm long, 1–2.5 cm wide, acute. **Inflorescence** shorter than the pseudobulbs, in specimens seen about 1 cm long; ovary with pedicel 1.5 cm long. **Flowers** somewhat translucent, dull red, lip darker red and column orange with white tip (fide Ingram 832, SEL). **Sepals** ovate-lanceolate, 1.8–2 cm long, 5.5–7.5 mm wide, acute; lateral sepals somewhat oblique. **Petals** linear to narrowly elliptic, acute, 1.5–1.8 cm long, 3–5.5 mm wide. **Lip** hinged to the column foot, 1.4–1.6 cm long, about 8 mm wide when spread, distinctly 3-lobate at about the middle; lateral lobes rounded and forming an acute but shallow sinus with the midlobe; midlobe oblong, apically rounded to bluntly acute; callus ligulate, somewhat raised apically and terminating at the middle, apex rounded to somewhat V-shaped. **Column** stout, 7–8 mm long excluding the anther (1.1 cm long including the foot); foot 4–5 mm long; anther about 2 mm in diameter; stipe short and viscidium concave.

Apparently a rare canopy epiphyte in lowland rain forests at 0–550 m. Flowering at least January, June, October, and December. Costa Rica and Panama.

Maxillaria longipetiolata is easily distinguished by the long petiolate leaf and the much abbreviated scape with flowers produced at the base of the pseudobulbs. It is clearly related to South American *M. auyantepuiensis* Foldats.

Maxillaria lueri Dodson, Icon. Pl. Trop. 2: t. 155. 1980. TYPE: Ecuador, Pichincha, 300 m, Dodson & Luer 6800 (holotype: SEL). Figure 2A.

Plant a pendent, somewhat straggly epiphyte to 1 m long (Ecuador); stem concealed by black-warty imbricate sheaths. Roots to 1 mm in diameter. **Pseudobulbs** terete, surrounded by leaf sheaths, apically 1-foliate and surrounded basally by 3–4 well-developed leaves. **Leaves** narrowly linear, the larger at least 30 times as long as wide, articulate to the sheath, linear, to 40 cm long, less than 5 mm wide. **Inflorescences** borne on short peduncles concealed by the leaf bases; ovary length about 1.5–2 cm exceeded by the floral bract. **Flowers** poorly known in fresh condition, pinkish white. **Sepals** dissimilar; dorsal elliptic, 1.8 cm long, 7 mm wide, acute; lateral sepals obliquely ovate, to 2.5 cm long, 1 cm wide, adnate to the column foot. **Petals** obliquely elliptic, to 1.5 cm long, 6 mm wide. **Lip** about

2 cm long, apically 3-lobate, the midlobe about $\frac{1}{4}$ the length of the lip, its blade with a central ligulate callus. **Column** 7–8 mm long with a conspicuous foot of about the same length.

Uncommon epiphyte of rain forests at 50–500 m. Flowering October and December. Ecuador, Panama, and Costa Rica.

Maxillaria lueri is easily recognized by the long, narrow, pendent leaves and spotted sheaths.

Maxillaria maleolens Schltr. Repert. Spec. Nov. Regni Veg. Beih. 19:233. 1933. TYPE: Costa Rica, Alajuela, *Brenes 281* (lectotype: CR). Figure 17C.

Plant a large, coarse, caespitose epiphyte. Roots, white, large, to 3.5 mm in diameter. **Pseudobulbs** ovate, smooth, compressed, 5–9 cm long, 2.5–3.5 cm wide, apically 1-foliate, and subtended by 2 or more large leaf-bearing sheaths. **Leaves** subcoriaceous and rather tough, 16–42 cm long, 2.2–5.5 cm wide, oblong, variously petiolate, apically obtuse to unequally 2-lobate. **Inflorescence** a fascicle of successively flowering scapes; each scape 4–5 cm long, covered by somewhat flared, obtuse, apiculate bracts; ovary with pedicel furfuraceous, 1.2–1.8 cm long, much exceeding the subtending, much abbreviated, collar-like floral bract. **Flowers** leathery, presented perpendicularly to the line of growth, with fragrance similar to that of coconut, greenish yellow, with paler lip marked with red and with yellow calli. **Sepals** narrowly ovate, 2.3–2.6 cm long, 1–1.1 cm wide, cuspidate. **Petals** elliptic-oblong to lance-ovate, broadly acute, 1.8–2.1 cm long, 5–6 mm wide. **Lip** hinged to the column foot, rounded at the base, 1.8–2.2 cm long, 1.4 cm wide, 3-lobate just beyond the middle; midlobe triangular; callus thickened, biblike, extended to the middle, on which is superposed an additional linear raised callus, plus an additional ovate callus on the midlobe. **Column** arcuate, 1.4–1.5 cm long including the minutely papillose anther cap and the obsolete foot; pollinia 4, supported on a squarrose stipe and a saddle-shaped viscidium. **Capsule** ellipsoid, 3.5 cm long.

Apparently a rare, large, clumping epiphyte of premontane rain forests to 1150 m. Flowering throughout the year. Mexico (Veracruz) and Honduras to Panama; probably also in Guatemala.

Maxillaria maleolens is easily distinguished by the large plants with shoots producing several leaves at the pseudobulb base and yellow and red flowers with obtuse floral segments. The odor, resembling something between naphthalene and coconut, could be interpreted as “pleasant” despite the specific epithet meaning “bad odor.” Similar species, *M. discolor* (Lodd.) Rchb. f. and *M. villosa* (Barb. Rodr.) Cogn., may also occur in Costa Rica. *Maxillaria discolor*, known from adjacent Panama, has dark leaves with a purple abaxial

surface and yellow flowers that elsewhere in the range (Surinam) have an odor similar to that of very sharp cheese. A living plant apparently of *M. villosa* presumably collected in Costa Rica has appeared at Lankester Gardens. The species lacks the purple pigment in the leaves, but the flowers are yellow and lack perceptible fragrance. These species are excluded from the flora until they can be verified with field collections.

Maxillaria meridensis Lindl., Orch. Linden 19: No. 100. 1846. TYPE: Venezuela, near Merida, 6000 ft, *Linden s.n.* (holotype: K). Figure 6D.

Plant erect, forming canes; shoots 7–11 cm apart and terminated just above the swelling or indistinct pseudobulb, each shoot developing from the base of the swelling of the previous shoot, a feature obscured by closely imbricated, rugose-verrucose rhizome bracts. Roots to 1 mm in diameter. **Leaves** 4–6 per shoot, the lowermost abscising with age, the blades 5–28 cm from the articulation, and 3–9 mm wide. **Inflorescence** 1–2 per rhizome bract; scapes 4–5 cm long, covered by about 5 imbricate, acute sheaths to 2.3 cm long; ovary with pedicel shorter than the subtending bract, 1.5–1.8 cm long at anthesis. **Flowers** light yellow, sometimes tinged with pink; lip with two reddish spots. **Sepals** narrowly elliptic-lanceolate, 2–2.5 cm long, 5–7 mm wide; dorsal somewhat concave; lateral sepals forming a mentum around the column foot. **Petals** linear-lanceolate, arcuate, 1.8–2.4 cm long, 2–3 mm wide. **Lip** 1.2–1.4 cm long and about 7 mm wide, 3-lobate on the apical $\frac{1}{2}$; midlobe fleshy, triangular, verrucose, about 5 mm long; callus ligulate, reaching to just above the middle, thickened apically and rounded or somewhat parabolic in front. **Column** arcuate, 7–8 mm long excluding the anther; anther about 2 mm in diameter. **Capsule** 3.5 cm long.

Terrestrial on open embankments, often on windy and cloud-swept ridges; in Costa Rica known from Cordillera de Talamanca at about 1400–1800 m. Flowering March, May, August, and September. Northern South America south to Bolivia(?) and Costa Rica.

Maxillaria meridensis is similar to *M. exaltata* (Kraenzl.) C. Schweinf., a species of mostly lower elevations, although they may occur sympatrically (e.g., Tapanti). That species forms a much larger plant, and the ratio of the midlobe length to the entire lip length is $\leq \frac{1}{4}$. The corresponding ratio in *M. meridensis* is $\geq \frac{1}{2}$.

Maxillaria microphyton Schltr., Repert. Spec. Nov. Regni Veg. 8:457. 1910. TYPE: Costa Rica, in forests of La Palma, *Tonduz 9670* (isotype: US). *Ornithidium parvulum* Schltr., Repert. Spec. Nov. Regni Veg. 9:206. 1911 (based on

same collection as *M. microphyton*). *Ornithidium pallidiflavum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:143, 242–243. TYPE: Costa Rica, San Pedro de San Ramón, 1075 m, *Brenes 135* (isotype: AMES). *Maxillaria pallidiflava* (Schltr.) Senghas, Orchidaceen 29:1751. 1994. Figure 12B.

Plant an erect or pendent, cane-forming epiphyte to about 30 cm tall, rooted only on the lower shoots; stems much elongate, to about 7 cm long between pseudobulbs in the lower shoots, diminishing in successive shoots. Roots to about 1 mm in diameter. **Pseudobulbs** conic to suborbicular, never regularly furrowed in dried specimens, 0.7–2.5 cm long, subtended by 1–2-foliate sheaths, the apex 1-foliate. **Leaves** similar, those subtending the pseudobulb with sheath; apical leaf shortly petiolate; blades thin, elliptic, 1.5–6 cm long, 4–10 mm wide, rounded to emarginate. **Inflorescence** 1 per blade-bearing or non-blade-bearing sheath of both mature and immature shoots; ovary with pedicel 3–4 mm long, somewhat exceeded by the subtending acute floral bract. **Flowers** not opening widely or with sepals and petals recurved, sometimes minutely pubescent, variously colored, greenish yellow, often suffused or lined with dark red, apparently turning dark with age. **Sepals** subequal, elliptic, the laterals subfalcate, 6–12 mm long, 1.5–2.5 mm wide. **Petals** elliptic-lanceolate, sometimes attenuate, 6–10 mm long, 2–3 mm wide, acute. **Lip** straight in natural position, somewhat hinged to the column foot, ovate when spread, 3.5–4.5 mm long, to about 2 mm wide, 3-lobate below the middle; lateral lobes embracing the column and exceeding the callus, bluntly acute; mid-lobe ovate, obtuse to rounded; callus at the base fleshy, rounded and somewhat elevated in front. **Column** stout, arcuate, somewhat tapering, 2–3 mm long excluding the anther; foot about 0.5 mm long; anther less than 1 mm in diameter; pollinia 4, with somewhat squarrose stipe.

Locally abundant epiphyte or terrestrial of cloud forests at 1000–2000 m. Often found growing on shrubs. Flowering mostly June to November, also March and April. Costa Rica; expected in Panama.

The straight lip with lateral lobes exceeding the callus distinguishes this from similar species, especially *M. flava* and *M. wercklei*.

Although both *M. microphyton* and *Ornithidium parvulum* are based on the same collection, conceivably the names are based on separate specimens that might not have been the same species. In the absence of holotypes, there is no choice but to regard the second published name as a later synonym of the first.

Maxillaria minor (Schltr.) L. O. Williams, Amer. Orch. Soc. Bull. 10:273. 1942. *Camaridium minus* Schltr., Beih. Bot. Centralbl. 36, Abt. 2:417. 1918. TYPE: Costa Rica, La Palma, *C. Wercklé*

(holotype: CR?; drawing of type: AMES). Figure 13C.

Plant a straggly, pendent epiphyte to about 1 m long comprised of several successively borne shoots to 15 cm long, each consisting of a slender, wiry, scaly rhizome (cane) to about 3 mm in diameter terminated by a pseudobulb. Roots white, to barely 0.5 mm in diameter. **Pseudobulbs** ovoid to orbicular, biconvex, 1–2 cm long, to 1 cm wide, subtended when young by 1–2 leaf-bearing sheaths; apex 1-foliate. **Leaves** 4–8 cm long, 7–12 mm wide; blades of rhizome bracts with a broad sheath, narrowing abruptly above the articulation to a slender petiole. **Inflorescences** 1 per rhizome bract, produced precociously on the canes of developing shoots; scapes to about 5 mm long; ovary with pedicel 3–4 mm long, subtended by a cucullate, acute, or subulate floral bract. **Flowers** variable in color, mostly white to salmon pink, the lip yellow. **Sepals** similar; dorsal oblanccolate, 7 mm long, 3 mm wide, acute; lateral sepals obliquely ovate, 5 mm long, 2 mm wide. **Petals** oblanccolate-obovate, 5 mm long, to 2 mm wide. **Lip** hinged to the column foot, 3-lobate just above the middle, 3 mm long, about 2 mm wide, the midlobe fleshy, papillose, sharply deflexed, with a fleshy callus at the base and a second U-shaped callus at the base of the midlobe. **Column** stout, arcuate, 1.5 mm long, with a very short foot about 0.5 mm long. **Capsule** globose, about 6 mm long.

Epiphytic on the larger branches and trunks of trees in wet forests at 1000–2500 m. Flowering July to March. Costa Rica and Panama.

The small flowers formed precociously on immature canes and the straggly habit are immediate field characters for recognition. *Maxillaria minor* vegetatively resembles *M. paleata* (Rchb. f.) Ames & Correll, *M. schlechteriana* J. T. Atwood, *M. sigmoidea* (C. Schweinf.) Ames & Correll, and *M. vaginalis* Rchb. f., but of these has the smallest and most dully colored flowers. The entire complex of species is found at middle to high elevations, often growing sympatrically.

Maxillaria monteverdensis J. T. Atwood & G. Barboza, Lindleyana 9:241–242. TYPE: Costa Rica, intersection of Provinces of Alajuela, Guanacaste, and Puntarenas, Monteverde Reserve, *Atwood 89-33* (holotype: SEL; isotype: CR). Figure 7A.

Plant a large, erect, monopodial, cane-forming epiphyte in adults to at least 35 cm tall (probably much taller) with leafy canes lacking pseudobulbs; juveniles caespitose and with pseudobulbs. Roots mostly restricted to the base, to about 2 mm in diameter. **Pseudobulbs** of juveniles about 4.5 cm tall and 2.5 cm wide, compressed, sessile, apically 1-foliate with shortly petiolate leaf. **Leaves** thin, articulate; blade keeled below, 4–11 cm long, 1.5–2 cm wide; apex obtuse to rounded and unequally 2-lobate. **Inflorescence** several per leaf axil,

long for the genus and sometimes exceeding the subtending leaf; scapes to about 8 cm long, persistent; ovary with pedicel 1.3–1.5 mm long, subtended by a somewhat longer subulate, acute floral bract. **Flower** large for the genus, campanulate, to about 3.2 cm long, white to pinkish with lip yellow to orange, fragrant. **Sepals** similar, oblong, 2.5–3.1 cm long, about 5–7 mm wide, apex acute. **Petals** falcate-ob lanceolate, about 2.5–2.7 cm long, 6.5–9 mm wide, acute to acuminate. **Lip** somewhat rigid with the column foot, canaliculate on the lower $\frac{2}{3}$, 3-lobate on the upper $\frac{1}{3}$, about 1.5–1.8 cm long, 3.5–4 mm wide in natural position, to 2 cm long when spread; lateral lobes embracing the column; midlobe ovate, obtuse, and with crenulate margin; callus a truncate to rounded lamina terminating at about the lobe sinuses with a single papilla at the base. **Column** nearly straight, cylindric, 1.2–1.5 cm long excluding foot and anther; foot short, about 3 mm long.

Epiphytic in lower montane rain forests at 1500–1800 m. Flowering at least January to March. Costa Rica (Monteverde) and Panama.

Maxillaria monteverdensis is most closely related to *M. amabilis* but has longer ovaries and larger flowers, and the lip has a single papilla at the base instead of a distinct keel. The flowers resemble those of *M. vaginalis* Rchb. f., but the latter species distinctly has pseudobulbs terminating adult shoots. When described, *M. monteverdensis* was thought to be endemic to Monteverde, but specimens have now surfaced from Panama.

Maxillaria moralesii Carnevali & J. T. Atwood, Lindleyana 11:31–32. 1996. TYPE: Costa Rica, Alajuela, Río Angel, flowered in cultivation at Missouri Botanical Garden 25 Dec. 1994, *Carnevali & Morales 3841* (holotype: INB; isotype: SEL). Figure 22A.

Plant a caespitose or shortly creeping epiphytic herb 8–15 cm tall. Rhizome short; roots to 2 mm in diameter. **Pseudobulbs** pale yellow-green, clustered, ellipsoid or oblongoid, 2–3 cm tall, 0.8–1.5 cm wide and thick, but always wider than thick; subtended by non-foliaceous sheaths; apex 1-foliate. **Leaves** without petiole, erect on the pseudobulb, coriaceous, elliptic or lanceolate-elliptic, 6.5–25 cm long, 1.3–1.7 cm wide, acute. **Inflorescence** erect or spreading, shorter than pseudobulb, peduncle 8–12 mm long; ovary with pedicel 1.6–1.7 cm long, subtended by an obovate-elliptic floral bract 1.1–1.2 cm long, 6–7 mm wide. **Flowers** dull yellow-green, lip yellow with orange-maroon speckles, column pale green. **Sepals** somewhat fleshy, acute; dorsal ovate-elliptic, concave, 12.5–13.5 mm long, 6–7 mm wide; lateral sepals ovate, 12.5–13.5 mm long, acute, mucronulate. **Petals** lanceolate, 12.5–13.5 mm long, 3.8–4.2 mm wide, acute, mucronulate. **Lip** 3-lobate, 10.5–12 mm long, ca. 7 mm wide when expanded; lateral lobes triangular-ovate, obtuse, erect-uncinate, emerging from the lower $\frac{1}{3}$ of the lip; 1.2–1.5 mm long; midlobe ovate-oblong-subquadrate, evenly tapering from base to apex,

5.8–6.2 mm long, 2–2.5 mm wide, apex subtruncate-rounded; disc bearing a narrowly triangular farinose callus narrowing toward the midportion then thickening again. **Column** arcuate, 7.5–8 mm long, 3–4 mm wide; broadly winged near apex; column foot 2–2.5 mm long; anther smooth, 2.3–2.5 mm long. **Capsule** about 2.5 cm long.

Poorly known ecology, tropical lowland rain forests (e.g., La Selva Biological Station) to 900 m. Flowering November to February. Central Valley of Costa Rica; probably also Nicaragua and Honduras.

Four distinct members of the *M. rufescens* complex are treated separately here. *Maxillaria acutifolia* Lindl. is a small member with nearly cylindrical pseudobulbs and a yellow to green flower with the lip containing a red stripe up the center. *Maxillaria hedwigiae* Hamer & Dodson is a species with a white to green flower and an orange lip. Finally, *M. dressleriana* is a species with ovoid pseudobulbs and brownish maroon flowers. *Maxillaria moralesii* has been accepted variously as *M. rufescens* Lindl., a larger-flowered species from South America. It is possible that plants of *M. moralesii* and *M. acutifolia* as accepted here are indistinguishable.

Maxillaria muscoides J. T. Atwood, Lindleyana 9:236. 1994. TYPE. Costa Rica, Cerros el Humo de Pejivalle in the zone of Turrialba, *Dodson 2526* (holotype: SEL). Figure 12A.

Plant small, somewhat moss- or brushlike, to about 10 cm tall, consisting of a tuft of small, few-branched canes appearing somewhat caespitose; rhizome elongate, to 2 cm between pseudobulbs, rooted only at the base, concealed by scale bracts. Roots less than 0.5 mm in diameter. **Pseudobulbs** conic, somewhat grooved, to about 1.2 cm long and 5 mm wide, subtended by 3–4 foliaceous bracts; apex 1-foliate. **Leaves** acicular, terete, articulate, 1–3.5 cm long, about 1.5 mm in diameter, the apex obtuse and apiculate. **Inflorescence** 1 per foliaceous or nonfoliaceous rhizome bract appearing on the nearly mature shoot; scapes to about 1 cm long; ovary with pedicel 2–2.5 mm long, exceeded by the subulate floral bract. **Flowers** pale yellow, apparently not opening broadly. **Sepals** dissimilar; dorsal ligulate, somewhat concave, 5–5.5 mm long, 1.2–1.8 mm wide, acute, dorsally keeled at the apex; lateral sepals triangular-falcate, attached to the column foot, 5 mm long, less than 2 mm wide, acute. **Petals** elliptic-lanceolate, slightly falcate, 4–4.5 mm long, about 1.2 mm wide, acute. **Lip** hinged to the column foot, recurved in natural position, when spread (difficult) 3–3.5 mm long, 2–2.2 mm wide, shallowly 3-lobate at about the middle; lateral lobes rounded and somewhat embracing the column; midlobe ovate, acute, dorsally keeled; callus lamellate connecting the lateral lobes, ending at or below the sinuses. **Column** short, less than 2 mm long excluding the anther; foot about 1.8 mm long; anther 1.5 mm in diameter; pollinia

4, supported on a short, squarrose stipe with dark viscidium (dried material).

Epiphytic in premontane rain forests at 1350 m. Flowering August to November. Endemic to Costa Rica; known only from Tapantí.

In habit *M. muscoides* is unlike any other species known from Central America, and the needle-like leaves are reminiscent of certain Brazilian taxa; however, these other taxa have two leaves at the pseudobulb apex. Flower morphology indicates a distinct relationship with Costa Rican *M. microphyton* Schltr. Its small size renders it unable to compete with more showy orchids for the eye of all but the most ardent collectors.

Maxillaria nasuta Rchb. f., Beitr. Orch. Centr.-Am. 104. 1866. TYPE: Colombia, Lasita (holotype: w; isotype: k). *Maxillaria nasalis* Rchb. f., Saund. Ref. Bot. 2: t. 102. 1872. TYPE: Costa Rica, *Endres 266* (holotype: w). *Maxillaria brevipedunculata* Ames & C. Schweinf. Sched. Orch. 10:91. 1930. TYPE: Costa Rica, Toro Amarillo, A. Alfaro 190 (holotype: US; photo of type: AMES). Figure 17D.

Plant a robust, caespitose epiphyte of larger branches and trunks in evergreen forests. Roots large, to 5 mm in diameter. **Pseudobulbs** smooth, appearing varnished, not forming ridges when dry, ovate, compressed, 5–7 cm long, 2.5–3.5 cm wide, subtended by several leaf-bearing rhizome bracts, apically 1-foliate. **Leaves** linear, with a long conduplicate petiole, 20–65 cm long from the articulation, 2–3.5 cm wide, acute to obtuse. **Inflorescence** 2 or more per rhizome bract, successively borne, covered by several blunt flaring sheaths; ovary about 3 cm long. **Flowers** with leathery segments, green to yellow, the lip mostly red. **Sepals** lanceolate to elliptic, 3.5–4.5 cm long, 1–1.2 cm wide, acute. **Petals** elliptic, oblique at the base, 2–3 cm long, 5–7 mm wide, acuminate. **Lip** basally rounded, 2 cm long, 1.5 cm wide, 3-lobate from just above the middle; midlobe triangular, reflexed, callus on the lower half oblong but poorly defined, papillose, and cushion-like. **Column** arcuate, 1–1.4 cm long, the anther cap with a dark spot on each side. **Capsule** ellipsoid, 5 cm long.

A large, clumping epiphyte of larger branches in wet forests at 150–1500 m in Central America; to 2000 m in Ecuador. Flowering April to October in Central America. Mexico to Bolivia.

Specimens from higher elevations in Costa Rica and Ecuador often exhibit larger-scape bracts than do those from lower elevations, but the variation is probably continuous.

Maxillaria neglecta (Schltr.) L. O. Williams, Ann. Mo. Bot. Gard. 29:348, Fig. 4. 1942. Or-

nithidium neglectum Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:242. 1923. TYPE: Costa Rica, A. M. Brenes 164 ex R. Schlechter (pressed from cultivated material) (drawing of type: AMES). Not *Scaphyglottis pendula* Poeppig & Endl. *sensu* Brieger. Figure 9C.

Plant a straggly, usually somewhat pendent epiphyte often forming large clumps to about 50 cm across; rhizome elongate, concealed by bracts. Roots slender to 0.5 mm in diameter. **Pseudobulbs** cylindric, somewhat compressed, 1.8–3.5 cm long, 4–12 mm wide, spaced 1–5 cm apart, 1-foliate. **Leaf** chartaceous, linear to lanceolate, 7–20 cm long, 5–13 mm wide. **Inflorescence** a fascicle of scapes borne at the base of the most recently developed pseudobulb, the scapes much less than 1 cm long and concealed by the rhizome bracts; ovary 3–4 mm long. **Flowers** fleshy, white, the lip with yellow midlobe. **Sepals** concave and not opening widely, dorsal 5–6 mm long, 4–5 mm wide when flattened; lateral sepals about $\frac{1}{2}$ connate, each obliquely ovate, 5–7 mm long, 4.5–5.5 mm wide. **Petals** narrowly oblong-ovate, slightly constricted on the upper half 4–5.5 mm long, 1–2 mm wide, the apex rounded and apiculate. **Lip** 3-lobate, 4.5–6 mm long, 3–4 mm across when spread (difficult); lateral lobes broad, subquadrate, partially connected to the column foot and with straight or concave lateral margins; midlobe fleshy, ovate, and obtuse, $\frac{1}{4}$ – $\frac{1}{3}$ the lip; with a transverse ridgelike callus at the base of the midlobe connecting the lateral lobes. **Column** stout, straight, 1.2–2 mm long excluding the anther; foot at the base about 2.5 mm long; anther globose, about 1 mm in diameter. **Capsule** globose about 6 mm long, 5 mm wide.

Epiphytic in tropical evergreen forests; often over water at 0–900(1600?) m. Flowering August to November; fruiting by January. Honduras to Panama; possibly also Colombia.

Maxillaria neglecta (*sensu* L. O. Williams, Ann. Missouri Bot. Gard. 29:348. 1942) has traditionally included plants segregated below as *M. pseudoneglecta* (based on *Ornithidium anceps* Rchb. f.). *Maxillaria neglecta* is a more widespread, usually lowland species and has generally much more narrowly linear leaves. It is readily distinguished from *M. pseudoneglecta* (occasionally white-flowered) by the narrower lateral lobes of the lip with essentially straight outer margin. When spread, the lip is a maximum of 4 mm across in *M. neglecta* and always (4.5)5–7 mm across in *M. pseudoneglecta*. *Maxillaria neglecta* is distinguished from *M. brevilabia* by its generally smaller, linear, and acute leaves; the latter species has elliptic, obtuse leaves. Inflorescences of *M. brevilabia* develop along the entire length of the recently matured rhizome, not just at the base of the pseudobulb as in *M. neglecta*.

Maxillaria nicaraguensis (Hamer & Garay) J. T. Atwood, Selbyana 10:60–62. 1988. *Neourbania nicaraguensis* Hamer & Garay, Icon. Pl. Trop. 13: t. 1238. 1985. TYPE: Nicaragua, Department of Chontales, A. H. Heller 7057 (lectotype: SEL; isolectotypes: SEL, AMES). Figure 4B.

Plant a straggly decumbent epiphyte lacking pseudobulbs but often forming large clumps; stems ascending, to about 20 cm tall, unbranched above and sheathed by the bases of 6–12 distichous leaves to 5 cm apart. Roots white, to 1 mm in diameter. **Leaves** 4–7.5 cm long and 5–8 mm wide, oblanceolate-oblong, somewhat unequally 2-lobate at the obtuse apex, articulated to the somewhat inflated rugose sheath. **Inflorescence** appearing singly or in pairs in the leaf axils, the peduncle plus ovary 1–2 cm long. **Flowers** creamy yellow marked with red. **Sepals** oblong-lanceolate, 8–9 mm long, 1.5 mm wide. **Petals** obliquely oblong-lanceolate, 6–7.5 mm long, 1.5–2 mm wide. **Lip** rigidly attached to the base of the column, oblong-pandurate, constricted in the middle, 5–8 mm long, 2–2.5 mm wide; basal half concave and parallel to the column; apical $\frac{1}{2}$ reflexed and with a crenulate margin. **Column** arcuate, about 4 mm long; foot nearly absent. **Capsule** ellipsoid, about 1.25 cm long.

Epiphytic in larger branches of tree crowns of wet lowland forests at 50–900 m. Flowering November and December. Nicaragua and Costa Rica.

Although represented at La Selva Biological Station by a single collection, it is quite common there but probably rarely seen in flower. A short flowering period would account for the few collections having been made.

Maxillaria cf. obscura Lind. & Rchb. f., Beitr. Orchid.-K.C.Amer. 31–32, t. 6. 1866. TYPE: Colombia (including Panama). Figure 22B.

Plant a caespitose epiphyte to perhaps 20 cm tall. Roots white, to about 1.25 mm in diameter. **Pseudobulbs** compressed, ovoid to suborbicular, 1.5–4.5 cm long, 1–2.5 cm wide; base subtended by 1–2 subulate bracts with articulation but without definite blade; apex usually somewhat emarginate, 1-foliate. **Leaves** shortly petiolate (petiole $< \frac{1}{3}$ blade); blade narrowly elliptic, 5–29 cm long, 1.2–2.9 cm wide, bluntly acute to obtuse and unequally 2-lobate. **Inflorescence** apparently 1 per bract axil of the mature shoots, to about 5 cm long; ovary with pedicel (1.6)1.8–2 cm long, trigonous, exceeded by a cucullate, acute floral bract. **Flowers** maroon to brown, or with sepals and petals yellow stained with maroon. **Sepals** similar, broadly oblanceolate to elliptic, acute; dorsal somewhat concave, 1.7–2.1 cm long, 5–6.5 mm wide; lateral somewhat oblique, 1.8–2.1 cm long, 5–6 mm wide. **Petals** broadly oblanceolate, 1.5–1.7 cm long, 4–5 mm wide, acute. **Lip** hinged to the column foot, recurved, 3-lobate below the middle, 1–1.2

cm long, 6–7 mm wide when spread; lateral lobes rounded and often slightly indented near the apex; midlobe ovate, fleshy, 6–7 mm long, about 4–4.5 mm wide, acute to obtuse and thickened near the apex; callus terminating at about the divergence of the lateral lobes, trapezoid, thickened in front, somewhat canaliculate toward the base. **Column** stout, arcuate, 5.5–7 mm long excluding the anther; foot 2–3 mm long.

Maxillaria cf. obscura grows in upper montane cloud forests at 1500–3000 m. Flowering November to May. Costa Rica and Panama.

This species, variously accepted as *M. cucullata* Lindl. (*sensu lato*) or *M. atrata* var. *brachyantha* Rchb. f., is restricted to southern Costa Rica and Panama. *Maxillaria cf. obscura* is unique among the *M. cucullata* Lindl. complex in southern Central America in the trigonous ovary, relatively short column, and trapezoid callus of the lip. It is also unique in the complex for its narrower petioles and smaller flowers, which are either dark maroon or have sepals and petals that are yellow stained with maroon. They are never lined with maroon dots as in *M. punctostriata* Rchb. f. *Maxillaria cf. obscura* is perhaps most closely related to *M. lexarzana* Soto & Chiang from Mexico but has smaller flowers with a shorter column. Also, that species flowers at the end of the rainy season (August to October), while this species flowers during the dry season.

The name *M. obscura* is based on a plant with its origin given as “Columbia,” which included Panama at the time of publication. The relatively long midlobe of the lip apparent in the plate accompanying the original description matches the plants described here. No type specimen has been located.

Maxillaria oreocharis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:69. 1922. TYPE: Panama, Chiriquí, Powell 256 (isotype: AMES). Figure 15C.

Plant a large, somewhat scandent epiphyte with ascending shoots 1–6 cm apart, with only the lowermost forming roots. Roots white, to about 1 mm in diameter. **Pseudobulbs** ovate, apically 1-foliate, strongly compressed laterally, 1.5–4 cm long, 1–2 cm wide, subtended by bladeless rhizome bracts (at maturity), the leaf articulation oblique. **Leaves** linear, shortly petiolate, the blade 13–30 (39) cm long, 5–15 mm wide, acute. **Inflorescences** 1 per each of several concealing rhizome bracts of the mature shoot, 1.5–2.5 cm long, with 3 or more acute sheaths; ovary with pedicel 2–2.5 cm long, far exceeding the subtending floral bract. **Flowers** complex in color, the sepals red exteriorly, pink interiorly, the petals white to yellow (yellowing with age?); lip red, the apical $\frac{1}{3}$ yellow. **Sepals** narrowly ovate-lanceolate,

1.5–1.8 cm long, 4–5 mm wide, acute. **Petals** obliquely lanceolate, 1.2–1.6 cm long, 3–5 mm wide. **Lip** about 1.2 cm long, 6 mm wide when spread, hinged to the column foot, oblong, somewhat constricted at the base of the apical $\frac{1}{2}$; apex fleshy, reflexed; callus ligulate, reaching to just beyond the middle. **Column** to about 10 mm long with anther; foot 2 mm long.

Epiphytic in wet forests at 100–1100 m. Flowering August to December (February). Nicaragua to Panama.

This species is easily distinguished from closely related *M. alba* (Hook. f.) Lindl. and *M. anceps* Ames & C. Schweinf. by the narrower, acute leaves and by the purple color in the somewhat smaller flowers, which are borne within the rhizome bract axils of mature shoots.

Maxillaria pachyacron Schltr., Repert. Spec. Nov. Regni Veg. 9:165. 1911. TYPE: Costa Rica, La Palma, A. Tonduz 9681 (isotype: AMES), Ingram & Ferrell 770 (epitype selected here: SEL). Figure 24B.

Plant epiphytic, caespitose, forming small clumps to about 12 cm tall. Roots to 1 mm in diameter. **Pseudobulbs** narrowly to broadly ovoid, 1–2 cm long, subtended by 1(2) leaf-bearing rhizome bracts, apically 1-foliate. **Leaves** distinctly petiolate, the petiole to about $\frac{1}{2}$ the blade length and narrowed at the articulation; blade elliptic-ovate to linear, 5–20 cm long, 1.5–3.5 cm wide, acute, the apex often recurved. **Inflorescence** often reaching above the leaves, to 25 cm high; scapes wiry, nearly covered by 4–5 acute to obtuse, involute sheaths 1.5–2.5 cm long; ovary with pedicel lepidote, usually longer than the subtending bract, 2.3–3.5 cm long. **Flowers** spidery, the segments tan apically, whitish basally turning brown with age. **Sepals** lance-attenuate, 3.5–5 cm long; dorsal 3–4 mm wide; lateral sepals 4–5 mm wide near the base. **Petals** lanceolate, falcate, 2–3 cm long, 3 mm wide. **Lip** obovate, 1.3 cm long and 6–7 mm wide, 3-lobate on the apical $\frac{1}{2}$; midlobe very fleshy, with a ligulate callus extended to just below $\frac{2}{3}$ the lip, parabolic, thickened and elevated in front. **Column** arcuate, 1 cm long, including the 5-mm-long foot, anther bed papillose, pollinia 4, on a saddle-shaped viscidium. **Capsule** somewhat obovoid.

Common in cloud forests at 1000–1900 m. Flowering July to March. Nicaragua to Panama.

This species was synonymized by Ames under *M. reichenheimiana* Endres & Rchb. f., but that species has a longer mentum (chin) formed around the longer column foot besides the more obvious broader, white-spotted, and usually emarginate leaves. *Maxillaria arachnitiflora* Ames & C. Schweinf. is also similar but has more acuminate sepals, often spiraled near their apices, and a much longer column foot, and its floral bract ex-

ceeds the ovary. The similar *M. chionantha* J. T. Atwood has longer pseudobulbs, proportionately broader leaves, and a longer midlobe and grows at lower elevations.

The identification of *M. pachyacron* Schltr. is based on the original description and on the only known isotype (drawing), at Harvard. The drawing shows not only the small midlobe of the lip but also a broad leaf, suggesting that Schlechter constructed a monstrosity from different specimens, possibly representing different species. Because it could be confused with *M. chionantha*, an epitype is designated for clarification in the absence of other original material. As a further complication, a specimen with a label consistent with the collection data in the original description of *M. pachyacron* has surfaced at US, but the flower is clearly much smaller than that indicated in the description and has a very dissimilar lip. Furthermore, the plant has long rhizomes, whereas the original description indicates “rhizomate valde abbreviato.” This plant is *M. schlechteriana* J. T. Atwood, and the label seems to have been combined with the specimen in error.

Maxillaria paleata (Rchb. f.) Ames & Correll, Bot. Mus. Leaflet 11:15. 1943. *Ornithidium paleatum* Rchb. f., Linnaea 41:36. 1877. TYPE: Central America (holotype: w). *Camaridium wrightii* Schltr., Repert. Spec. Nov. Regni Veg. 16:448. 1920. TYPE: Nicaragua, Wright s.n. (isotype: AMES). *Maxillaria wrightii* (Schltr.) Ames & Correll, Bot. Mus. Leaflet 11:18. 1943. Figure 13E.

Plant a straggly, pendent epiphyte, somewhat branched, to about 1 m long, anchored only at the base; successively borne shoots to 25 cm long, diminishing above, each consisting of a slender, wiry, scaly rhizome (cane) to about 4 mm in diameter terminated by a pseudobulb. Roots white, less than 1 mm in diameter. **Pseudobulbs** ovoid to orbicular, biconvex, 1–5 cm long, to 2.5 cm wide, subtended when young by 1–4 leaf-bearing rhizome bracts. **Leaves** 2–23 cm long, 0.5–4.5 cm wide; blades of rhizome bracts with a broad sheath, narrowing abruptly above the articulation to a slender petiole, the apex acute. **Inflorescence** short, lateral, single flowered, produced precociously on the canes of developing shoots; scapes to about 2 cm long; ovary with pedicel 6–9 mm long, subtended by a subulate bract 1.2–1.7 cm long. **Flowers** reddish purple. **Sepals** similar; dorsal oblanceolate, 1.6–2.1 cm long, 4–4.5 mm wide, acute; lateral sepals obliquely ovate, 1.6–2.1 mm long, 5 mm wide. **Petals** elliptic-lanceolate to oblanceolate, 1.5–1.8 cm long, to 5–5.5 mm wide. **Lip** more or less fixed to the column foot, 3-lobate just above the middle, 9–10 mm long, about 2.5 mm wide; base subsaccate; midlobe fleshy, papillose, sharply flexed; callus fleshy, tongue-

like at the base, ending at about the sinuses between lateral lobes. **Column** stout, straight, 3.5–4.5 mm long excluding anther; foot nearly obsolete, to about 1 mm long.

Epiphytic and terrestrial in montane forests at (900)1200–3000 m. Flowering July to March; probably throughout the year. Southern Nicaragua (Volcán Maderas) to Panama.

Maxillaria paleata is similar to *M. minor* (Schltr.) L. O. Williams but has much larger, magenta flowers. Most authors have accepted *M. schlechteriana* J. T. Atwood (as *M. wrightii* var. *imbricatum* (Schltr.) Ames & Correll) as a variety of what is accepted here as *M. paleata*. However, no hybrids are known in areas of sympatry between that entity with smaller, lighter lavender flowers and *M. paleata*.

A search for the type of *Ornithidium paleatum* at the Reichenbach Herbarium has shown that the name *M. paleata* has been misapplied to a similar species, *M. dichotoma* (Schltr.) L. O. Williams. The misapplication is based on a poor drawing of the lip, which is grossly similar to that of *M. dichotoma*, but reexamination shows the characteristic sigmoid shape consistent with *M. wrightii*.

Maxillaria parviflora (Poeppig & Endl.) Garay, Bot. Mus. Leaf. 21:258. 1967. *Scaphyglottis parviflora* Poeppig & Endl., Nov. Gen. ac Sp. 1:58, t. 1836. TYPE: Peru, Cuchero, *Poeppig* (holotype: w). *Pseudomaxillaria parviflora* (Poeppig & Endl.) Brieger, Bot. Jahrb. Syst. 97:555. 1977. *Ornithidium confertum* Griseb., Fl. Br. W. Ind. Isl. 626. 1864. TYPE: Trinidad; Cuba, *Wright* 650 (isotypes: GOET, USF). *Maxillaria conferta* (Griseb.) C. Schweinf. ex Leon, Contrib. Ocas. Mus. Hist. Nat. Coleg. de la Salle 8:395. 1946. *Ornithidium chloroleucum* Barb. Rodr., Gen. et Spec. Orch. Nov. 2:208. 1882. TYPE: Brazil. *Pseudomaxillaria chloroleuca* (Barb. Rodr.) Hoehne, Arquiv. Bot. Estad. S. Paulo 2:72. 1947. *Maxillaria simulans* Ames & C. Schweinf. Sched. Orch. 10: 99, t. 1930. TYPE: Guatemala, *Tuerckheim* 8302 (holotype: AMES). Figure 9D.

Plant a straggly rhizomatous epiphyte to about 40 cm across, rooted only at the lowermost shoots; rhizomes elongate, concealed by bracts, to about 4 mm in diameter. **Roots** white, rarely exceeding 0.5 mm in diameter. **Pseudobulbs** cylindric to ovoid, compressed, 1.5–4 cm long, 6–12 mm wide, spaced 1–7 cm along the rhizome, subtended by a pair of subulate nonfoliaceous bracts, apically 1-foliate. **Leaf** subcoriaceous, shortly petiolate, the blade lanceolate to linear, 9–20 cm long, 9–20 mm wide, acute. **Inflorescences** fascicled at the base of the most recently matured pseudobulb and usually with the

flush of new growth; scapes < 1 cm long and hidden by the rhizome bracts; ovary and pedicel 3.5–4.5 mm long. **Flowers** white to light yellow (apparently purplish in Jamaican populations) with orange-yellow lip. **Sepals** ovate, concave, carinate apically, acute; dorsal 4.5–7 mm long, 2–3 mm wide; lateral sepals $\frac{1}{2}$ connate, 4.5–6 mm long, 2–3 mm wide. **Petals** ovate-elliptic, 3–4 mm long, 1.2–2.5 mm wide, acute. **Lip** fleshy, continuous with the column foot; blade deltate to 3-lobate, 2.5–4 mm long, 1.5–2.5 mm across when spread; side lobes somewhat erect; midlobe ovate and obtuse; callus at the base emarginate and a second, larger, emarginate callus in front continuous with the lateral lobes. **Column** stout, about 1.5 mm long excluding the globose anther. **Cap-sules** globose, 7–8 mm long.

An epiphyte of seasonally dry forests at 0–1100 m. Phenological data are lacking for Costa Rica, but in Chiapas to Honduras flowering specimens have been collected from September to November. As here interpreted, *M. parviflora* ranges from Southern Chiapas, Guatemala, Belize, and Honduras to Florida (USA), the Caribbean arc, and probably much of tropical South America. It seems oddly absent from mainland Nicaragua to Panama, but specimens exist representing Isla del Coco (Costa Rica), an island with floristic affinities in South America.

This is the smallest-flowered low-elevation species of the *M. neglecta* complex, which is characterized by partially connate lateral sepals. It is easily distinguished by the nearly absent mentum and by the cuneate lip, which lacks the broad lateral lobes seen in *M. neglecta* and *M. pseudoneglecta*.

Maxillaria parviflora from South America probably includes *Ornithidium rhomboglossum* Schltr., *M. exigua* Regel, and *M. surinamensis* Focke ex Rchb. f. as synonyms.

Maxillaria parvilabia Ames & C. Schweinf., Sched. Orch. 8:62–64. 1925. TYPE: Costa Rica, Province of San José, La Palma, *Standley* 32939 (holotype: AMES; isotype: US). Figure 4D.

Plant an epiphyte often more than 1 m tall; rhizomes forming upright or decumbent, often much-branched, leafy canes to 1 cm in diameter lacking pseudobulbs (apparently also as juveniles), concealed by imbricate sheaths. Roots mostly at the base but also along the canes, to about 1.2 mm in diameter. **Pseudobulbs** apparently absent in juvenile shoots. **Leaves** distichous, often with persistent blades restricted near the stem apex, the sheath minutely rugose and yellowish in dried specimens; blade deciduous, coriaceous, linear, 3.5–14 cm long, 8–15 mm wide, the base narrower than the sheath, the apex unequally 2-lobate. **Inflorescences** 1–several per leaf sheath; scapes 2–4 cm long, mostly concealed by acute, involute sheaths; ovary with pedicel 6–8 mm long exceeded by the subtending floral bract.

Flowers very fragrant, clear or light yellow, lip marked with red. **Sepals** dissimilar; dorsal elliptic, 1.4–2 cm long, 4–5 mm wide, acute; lateral sepals falcate-lanceolate, 1.3–1.9 cm long, 4–5 mm wide, acute. **Petals** elliptic-ob lanceolate, 1.2–1.7 cm long, 4–4.5 mm wide, acute. **Lip** hinged to column foot, 5–6 mm long, 3–3.5 mm wide when spread, cuneate at the base, 3-lobate above the middle; lateral lobes rounded and clasping the column; midlobe rounded to subtriangular; callus low, fleshy, ligulate ending below the middle. **Column** straight, 2–2.5 mm long excluding the anther; foot about 2 mm long.

Epiphytic and common in cloud forests at 1200–2300 m, particularly in wind gaps; otherwise, little is known of its ecology. Flowering November to March. Mostly along Continental Divide in Costa Rica and western Panama.

Among similar cane-forming species, this one is unique in its small lip-to-dorsal sepal ratio ($< \frac{1}{2}$) and the yellow and very fragrant flowers.

Maxillaria piestopus Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:302. 1923. TYPE: Costa Rica, San Ramón. *Tonduz s.n.*, May 1913 (destroyed), *Lankester 1213* (neotype selected here: AMES 34211). Figure 19C.

Plant a caespitose, erect epiphyte to 11 cm tall. Roots to 1.5 mm in diameter. **Pseudobulbs** suborbicular, about 1.2 cm tall, subtended by apparently nonfoliaceous bracts; apex 1-foliate. **Leaves** oblanceolate, erect, obtuse, sessile, 8–9 cm long, 1.1–1.3 cm wide. **Inflorescence** erect, subequal to the flower, produced at the base of immature shoots; peduncle about 5 cm long, compressed, with 4–5 large, triangular, obtuse sheaths; ovary with pedicel 2.5–2.8 cm long, triquetrous, about as long as the floral bract. **Flowers** pale yellow; lip with red spotting. **Sepals** dissimilar, dorsally carinate, 1.7–2 cm long; dorsal oblong, with somewhat dilated, obtuse to rounded apex; lateral sepals oblique at the base, narrowly oblong, subacute. **Petals** oblanceolate to spatulate, 1.2–1.3 cm long, rounded. **Lip** hinged to the column foot, 1.3–1.6 cm long, 7–10 mm broad when spread, distinctly 3-lobate at about the middle; lateral lobes small, obtuse; midlobe suborbicular to obovate, apparently without callus. **Column** slender, semiterete, arcuate, about 1 cm long, foot perhaps 2 mm long.

Apparently very rare; known only by a photograph of the holotype and by the neotype. Probably epiphytic, but nothing is known of its ecology. The type was collected in flower in May. Endemic to Costa Rica; the Lankester specimen was collected in Orosi.

Maxillaria piestopus is (or was) a distinct species with a unique oblanceolate leaf and large, triangular bracts of the scape (dried specimens), which are characteristic of no other species

known from Costa Rica. Also, the triquetrous ovary, oblanceolate petals, and large midlobe of the lip are unique. This species seems most similar to a Bolivian species described as *Mormolyca fuchsii* J. T. Atwood, which has similar scape bracts, a winged ovary, and otherwise similar flowers. It is possible that *Maxillaria piestopus* belongs with *Mormolyca*.

The above description is condensed from Schlechter's original and augmented by measurements taken from the neotype. The photograph of the destroyed holotype is rejected as a neotype because the photograph is not part of the original collection and cannot be dissected. The photograph, however, shows a drawn dissection showing Schlechter's concept of *M. piestopus* that is consistent with the neotype.

Maxillaria pittieri (Ames) L. O. Williams, Ann. Missouri Bot. Gard. 29:349. 1942. *Ornithidium pittieri* Ames, Sched. Orch. 2:36–37. 1923. TYPE: Costa Rica, San Isidro de Heredia, *Pittier 14048* (holotype: AMES; isotype: US). Figure 6B.

Plant a branched, somewhat straggly, mostly pendent epiphyte to nearly 2 m long; each shoot 10–15 cm long; stems somewhat curved. **Roots** mostly on the lower shoots where anchored, to 5 mm in diameter. **Pseudobulbs** lacking. **Leaves** 4–8 clustered near the stem apex, articulate to the sheath; blade coriaceous, very narrowly elliptic, 6–18 cm long, 1–2.2 cm wide, conduplicate at the base, somewhat concave apically, acute. **Inflorescences** densely aggregated at the base of completed shoots, the scapes about 2 cm long and hidden by the leaf bases; ovary with pedicel 1–1.4 cm long. **Flowers** mauve to pink, sometimes spotted with crimson, the lip apex yellow to green. **Sepals** similar, ovate, somewhat fleshy toward the apex, 7–9 mm long, 3.5–5 mm wide, acute to obtuse. **Petals** obovate, similar to the sepals, 6–7 mm long, 2.5–3.5 mm wide. **Lip** simple, rigidly adnate to the column foot, 4–5 mm long, 2.5–3 mm wide; apical half somewhat reflexed and quite fleshy, with a fleshy, bifid callus at about the middle. **Column** stout, straight, 2.5–3 mm long without the anther; foot 2.5–3 mm long, swollen apically; anther about 1 mm in diameter.

Apparently an uncommon epiphyte of cloud forests at 1500–2500 m. Flowering September, November, January, and May. Costa Rica and Panama.

Maxillaria pittieri differs from similar *M. fulgens* (Rchb. f.) L. O. Williams by its lack of pseudobulbs, usually somewhat curved stems, and somewhat larger, mauve to pink flowers (orange to red in *M. fulgens*) produced at the base of the most recently completed shoot. Flowers of *M. ful-*

gens are produced precociously within the bud scales of a developing shoot.

Maxillaria cf. planicola C. Schweinf., Bot. Mus. Leaf. 8:188. 1940. Based on *Camaridium latifolium* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:74. 1922. TYPE: Panama, on hills near Panama City, *Powell* 8 (lectotype: AMES; isolecotype: AMES). Figure 11A.

Plant poorly known, a rhizomatous epiphyte; rhizome segments about 15 cm long between pseudobulbs, concealed by imbricate, incurved bracts. Roots to about 1 mm in diameter. **Pseudobulbs** lance-ovoid, strongly compressed laterally, about 7 cm long, 2 cm wide; base concealed by nonfoliaceous sheaths; apex 1-foliate. **Leaf** shortly petiolate; blade thin, elliptic, 22–32 cm long, 5–6 cm wide, acute. **Inflorescences** 2 or more per rhizome bract of apparently immature shoots (mature fide Fl. Pan.); ovary 1–1.5 cm long. **Flower** large, white, the lip with yellow (spots?) on the lower half. **Sepals** narrowly elliptic, 3–3.5 cm long, 7.5–9 mm wide, acute; lateral sepals somewhat oblique. **Petals** ligulate, somewhat oblanceolate, about 3 cm long, 6 mm wide, acute to obtuse. **Lip** attached to the column foot, 3-lobate on the upper half, the lower half curved in such a way as to form an extra pair of more obscure lobes, about 1.5 cm long and 1.5 cm wide when spread; lateral lobes embracing the column, rounded; midlobe ovate, rounded, reflexed; callus a thick, fleshy ligule ending at about the middle, with variously furcate hairs on the lower $\frac{2}{3}$. **Column** arcuate, about 11 mm long excluding the anther, with nearly obsolete foot at the base. **Capsule** ellipsoid-ovoid, about 4 cm long.

Primary forests below 450 m. Panama and Costa Rica (Río Agua Buena, Rincon de Osa).

The single Costa Rican collection with two available duplicates (*Liesner* 2010 at MO, SEL) exhibits fruit only but is most likely the above species. Both specimens show the elongate rhizome covered by incurved bracts, nonfoliaceous sheaths, and laterally much flattened, 1-foliate pseudobulbs characteristic of *M. planicola*. Also, the broad leaf at the pseudobulb apex, inflorescence size, and fruit with persistent column are consistent with that species. The above description of the flower is based on analysis of the isolecotype (AMES).

Maxillaria ponerantha Rchb. f., Bonplandia 2: 17. 1854. TYPE: Venezuela, around Caracas, *Wagener* s.n. (holotype: w). Figure 7E.

Plant small, to about 20 cm tall, somewhat straggly with ascending, leafy shoots 1–2 cm apart and rooted only at the base. Roots white, to about 0.5 mm in diameter. **Pseudobulbs** apically 1-foliate in Costa Rican material (2-foliate in the type description), oblong, com-

pressed, to 1.5 cm long and 5 mm wide, subtended when young by 3 or more leaf-bearing, rugose sheaths. **Leaves** oblong, 1–2.5 cm long, 2.5–6 mm wide, apically unequally bilobed. **Inflorescence** 1 per rhizome bract axil of the immature shoot; scape about 5 mm long covered by 2 or more acute scape bracts to 7 mm long and hidden from view by the rhizome bracts; ovary with pedicel slightly exceeding the subtending floral bract, 7–8 mm long. **Flowers** dark purple in Costa Rican material. **Sepals** elliptic-oblong, dorsally carinate apically, 8 mm long, 2.5 mm wide, acute. **Petals** linear-oblong to oblanceolate, 6 mm long, 1.5 mm wide, obtuse. **Lip** hinged to the column foot, narrowly obovate, slightly 3-lobate, the constriction at the final $\frac{1}{3}$ forming the large midlobe, margin minutely papillose; callus fleshy, oblong, thickened and rounded in front, to about $\frac{1}{2}$ the lip. **Column** arcuate, somewhat broadened apically, about 5 mm long; foot about 1.5 mm long.

Epiphytes forming dense colonies in premon-tane rain forests to about 700 m. Flowering June to September. Northern South America and Costa Rica (Puntarenas).

Plants conform to the type description of *M. ponerantha*, but the flowers are much darker in color and similar to a photograph of a plant from Surinam published by M. C. M. Werkhoven (*Orchids of Surinam*, p. 156. 1986) under the same name. Also, the pseudobulbs in Costa Rican material are apically 1-foliate, not 2-foliate. A low-elevation species, it is expected to exhibit a broad geographic range. Plants have often been misidentified as *M. foliosa* Ames & C. Schweinf. (= *M. acervata* Rchb. f.), but that species is somewhat larger, has apically 2-foliate pseudobulbs (in Costa Rican material), has slightly larger light green flowers with a reddish lip, and occurs in cloud forest regions at more than 1000 m. The difference in elevation preference between these two species doubtless provides them with little opportunity for hybridization.

Maxillaria pseudoneglecta J. T. Atwood, Lindleyana 8:30–31. 1993. *Ornithidium anceps* Rchb. f., Beitr. Orchid. -K.C. Amer. 75–76. 1866. TYPE: Costa Rica, Cartago, *Wendland* s.n. (holotype: w). *Not Maxillaria anceps* Ames & C. Schweinf. 1930. Figure 10B.

Plant a straggly, somewhat pendent epiphyte forming loose clumps, rooted only along the basal shoots; rhizome elongate, to 6 mm in diameter. Roots rarely more than 0.5 mm in diameter. **Pseudobulbs** cylindric to ellipsoid, rarely globose, compressed, 1.5–3 cm long, 0.7–1.8 cm wide, spaced 1–8 cm apart, subtended by a pair of subulate bracts, apically 1-foliate. **Leaf** shortly petiolate; blade lanceolate, 5–15 cm long, 1–2.8 cm wide, acute. **Inflorescence** a fascicle of single-flowered scapes at the base of the most recently matured pseudobulb;

scapes less than 1 cm long, concealed by the rhizome bracts; ovary and pedicel 4.5–6 mm long, concealed by inflated bracts. **Flowers** variously yellow (lip with orange midlobe), entirely orange, or white and lip with orange midlobe. **Sepals** concave and not well spread; dorsal oblong-ovate, 5.5–7.5 mm long, 2.2–3.5 mm wide, apiculate; lateral about ½ connate, more or less obliquely ovate, apiculate, 5–9 mm long, 4–5 mm wide. **Petals** oblong, constricted on the upper half, 4–6.5 mm long, 1.5–2 mm wide, obtuse. **Lip** continuous with and not distinct from the column foot, 3-lobate, 5–7 mm long, (4.5)5–7 mm across the lateral lobes when spread; side lobes deep with convex lateral margins; midlobe fleshy, triangular-ovate, occupying about ¼ the lip, with a transverse ridgelike callus at the base of the midlobe connecting the lateral lobes. **Column** stout, 1.5–2 mm long excluding the anther; anther globose, about 1 mm in diameter.

Epiphytic in premontane and montane forests at (500?)900–2200 m. Most seem to occur in evergreen forests, but plants growing in semideciduous forests with *Plumeria rubra* and *Cattleya skinneri* are known. Flowering June to September. Costa Rica (Cordillera de Tilarán) to Boquete, Panama.

Maxillaria pseudoneglecta is most similar to *M. neglecta* but has statistically larger flowers. Also, the lip has much broader lateral lobes with convex margins, and the leaves are broader and more lanceolate.

Maxillaria punctostriata Rchb. f., Linnaea 41: 23. 1877. TYPE: Costa Rica, *Low s.n.* (holotype: w). *Maxillaria rubrilabia* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:236. 1923. TYPE: Costa Rica, San Ramón, 1050 m, *Brenes 151* (destroyed); *Todzia 334* (neotype: F). Figure 22C.

Plant a caespitose epiphyte to about 30 cm tall. Roots white, to about 1.5 mm in diameter. **Pseudobulbs** compressed, ovoid to suborbicular, 2.5–6 cm long, 2–3 cm wide; base subtended by nonfoliaceous, subulate bracts; apex 1-foliate. **Leaves** indistinctly to shortly petiolate (<½ blade); blade narrowly elliptic, 10–25 cm long, 2–4 cm wide; apex obtuse, emarginate, and apiculate. **Inflorescence** 1 or more per rhizome bract axil; to about 10 cm long; ovary with pedicel 1.8–2.4 cm long, terete, exceeded by a cucullate, acute floral bract. **Flowers** yellow to orange with lines of small purple dots; lip deep maroon. **Sepals** similar, broadly oblanceolate to elliptic, acute; dorsal somewhat concave, 2.2–2.7 cm long, 6.5–8.5 mm wide; lateral sepals somewhat oblique, 2.1–2.7 cm long, 6–8.5 mm wide. **Petals** broadly oblanceolate, 1.6–2.1 cm long, 6–7 mm wide, acute. **Lip** hinged to the column foot, recurved, 3-lobate below the middle, 1.2–1.8 cm long, 7–8 mm wide when spread; lateral lobes rounded; midlobe ovate, fleshy, 8–10 mm long, 6–7.5 mm wide, acute to obtuse and thickened near the apex; callus terminating at about the divergence of the

lateral lobes, oblong to somewhat trapezoid, thickened in front. **Column** stout, arcuate, 9–11 mm long excluding the anther; foot 3–4 mm long. **Capsule** about 4.5 cm long.

Common in evergreen to semideciduous cloud forests at 1100–2400 m. Flowering March to August and November; fruiting in July. Costa Rica; possibly in northern Nicaragua masquerading under the name *M. cucullata* Lindl. owing to the need for a revision of the *M. cucullata* complex.

At least three species of the *M. cucullata* Lindl. complex occur in Costa Rica, this one with yellowish sepals with maroon dots arranged in lines and a nearly black lip, another (*M. cf. obscura* Lind. & Rchb. f.) with much smaller maroon or yellowish flowers tinted with maroon, and a third recently described as *M. cedralensis* J. T. Atwood & Mora de Retana with larger, cream flowers. If the painting and presumably the type of *M. cucullata* (from Mexico) showing a long peduncle and a yellow flower stained with purple is accurate, this species probably does not occur in Costa Rica. There is little doubt that the name *M. punctostriata* applies to Costa Rican material that match the above description. The neotype of *M. rubrilabia* matches *M. punctostriata* very well and is here accepted as a synonym.

There may be a fourth species in the north with larger yellow to orange flowers with a very large, inflated floral bract concealing the ovary. A specimen (*Mora 60*, INB) collected at Estación Cacao at 1100 m, Cordillera de Guanacaste, and Cantón de Liberia appears to be *M. mombachoensis* Heller ex J. T. Atwood, which was originally described from adjacent southern Nicaragua, or it may be new. The dried plant has rather thick leaves and a short scape, suggesting a relatively dry or windy cloud forest habitat. (See Addendum.)

Maxillaria quadrata Ames & Correll, Bot. Mus. Leaf. 6:16. 1943. *Ornithidium lankesteri* Ames, Sched. Orch. 4:52–53. 1923. TYPE: Costa Rica, San Cristobal, *Lankester & Sancho 421* (holotype: AMES). Figure 5B.

Plant a large, monopodial, cane-forming epiphyte or terrestrial to about 1 m tall, probably becoming pendent with size; juveniles unknown, but probably caespitose with each shoot terminating in a pseudobulb; mature stems sheathed with closely spaced, conduplicate leaves, mostly deciduous near the base with sheaths fragmenting into fibers. Roots slender, to about 1 mm in diameter. **Pseudobulbs** unknown; absent on mature stems. **Leaves** articulate, coriaceous, keeled beneath, shortly petiolate above the articulation, the blades 5–18 cm long, 1–2.8

cm wide, the apex unequally 2-lobate. **Inflorescences** several—many per leaf axil; scapes to about 10 cm long, not much exerted beyond the subtending leaf blade, clothed in acute sheaths; ovary with pedicel about 1.2 cm long, usually exceeded by the subtending floral bract. **Flowers** with somewhat recurved segments, pink to white. **Sepals** similar, oblong-oblancoolate, 1.7–1.9 cm long, 4–5 mm wide, the apex acute. **Petals** elliptic-oblancoolate, 1.2–1.5 cm long, 3.5–4.5 mm wide, apex acute to acuminate. **Lip** rigid with the column foot, more or less straight and not saccate on the lower $\frac{1}{2}$, 3-lobate above the middle, 4–5 mm long, 2.5–3 mm wide in natural position; lateral lobes well extended beyond the sinuses, rounded; midlobe ovate, rounded to emarginate, recurved; callus a truncate ligule ending just below the lobe sinuses, with an additional 3 or more papillae at the base. **Column** stout, 3–4 mm long excluding the anther; the anther about 1.5 mm in diameter.

Maxillaria quadrata appears to be a rare epiphyte or terrestrial in montane cloud forests at 1500–1900 (2400) m. Flowering December to March. Endemic to Costa Rica; to be expected in western Panama.

From its closest relative, *M. adolphii* Ames & Correll, it differs by its occurrence at lower elevations and by its more or less straight, nonsaccate lip with more elongate lateral lobes, which usually are concave, embracing the column.

Some herbarium specimens from upper elevations (to 2400 m) may actually represent hybrids of *M. adolphii* with *M. biolleyi* (Schltr.) L. O. Williams. The latter species as a potential parent would explain the relatively straight, simple lip in flowers that otherwise appear similar to flowers of *M. quadrata*.

Maxillaria ramonensis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:235. 1923. TYPE: Costa Rica, Santiago de San Ramón. *Brenes 154* (lectotype: CR; isolectotype: AMES). *Maxillaria brevipes* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:302. 1923. TYPE: Costa Rica, La Palma, *Wercklé 110* (photo of type: AMES). Figure 23D.

Plant a caespitose epiphyte forming small clumps 6–20 cm tall. Roots filiform, white, to 0.5 mm in diameter. **Pseudobulbs** approximate, ovoid to suborbicular, 1–2 cm long, to about 2 cm wide, subtended by nonfoliaceous bracts, or with a single foliaceous bract, the apex 1-foliate. **Leaves** long-petiolate; sheath of foliaceous bracts much broader than the petiole; petioles canaliculate, 1–4 cm long, to about $\frac{1}{2}$ the blade length; blade well defined, narrowly to broadly elliptic, rarely somewhat oblanceolate, acute to subattenuate apically. **Inflorescences** 1 or more per rhizome bract, the scape 1–3.5 cm long; ovary with pedicel 1–1.2 cm long, exceeded by the acute floral bract. **Flowers** apparently not opening

broadly; sepals and petals translucent cream-white with white veins aging reddish or brownish; lip white strongly suffused with red, the apex usually dark red. **Sepals** dissimilar; dorsal oblong-ovate, 9–12 mm long, 4.5–5.5 mm wide with obtuse, mucronate apex; lateral sepals inserted on the column foot, oblique, triangular, 1.5–1.8 cm long, 5–7.5 mm wide with bluntly acute to obtuse apex. **Petals** oblique at the base, ligulate to ovate, acute, 1–1.3 cm long, 3.5–4.5 mm wide; apex acute to obtuse. **Lip** hinged to the column foot, cuneate from the base, the apical $\frac{1}{5}$ – $\frac{1}{3}$ 3-lobate, 1.1–1.3 cm long, 5–6.5 mm wide when spread; lateral lobes rounded to somewhat angular in front and embracing the column; midlobe ovate, rounded in front. **Column** stout, arcuate, 4–5 mm long excluding the anther; foot 8–9 mm long; anther 2–2.5 mm in diameter; pollinia 4, supported on a squarrose stipe.

Epiphytic in premontane and lower montane rain forests at 500–1200(1500) m. Flowering May to December. Nicaragua to Panama; also reported from Honduras.

Maxillaria ramonensis lacks the fringed anther bed seen in *M. confusa* and has a much more stout column and a longer column foot than flowers of either *M. brachybulbon* Schltr. or *M. acostae* Schltr. *Maxillaria brevipes* is here interpreted as a small *M. ramonensis*. Both names are based on plants with stout columns and long column feet. The above description includes forms from Panama with a long midlobe and may prove to represent a different species.

Maxillaria reichenheimiana Endres & Rchb. f., Gard. Chron. 1678. 1871. TYPE: Costa Rica, *M. Endres* (holotype: w). Figure 24A.

Plant epiphytic, caespitose, forming small clumps to about 15 cm tall. Roots to about 1 mm in diameter. **Pseudobulbs** about 1–2 cm long, orbicular to ovoid, compressed, usually hidden by subtending bracts, 1(2) of which may bear a leaf blade. **Leaves** shortly and distinctly petiolate, the blade round to elliptic, 4.5–11 cm long, 2–4.5 cm wide, apically emarginate to obtuse and very rarely acute. **Inflorescences** usually held above the leaves, the scapes 5(2)–8 cm long, nearly concealed by 4–6 acute to obtuse bracts 1–2.5 cm long; ovary with pedicel shorter than the subtending floral bract, lepidote, 1.5–2.5 cm long. **Flowers** spidery, pale yellow aging brown. **Sepals** lanceolate, acuminate, 3–4 cm long; dorsal sepal 2.5 mm wide; lateral sepals 4 mm wide. **Petals** falcate, lanceolate, about 2.5 cm long, 4 mm wide, attenuate. **Lip** obovate, the apical $\frac{1}{6}$ 3-lobate, 1.3 cm long, about 6 mm wide; midlobe fleshy; callus ligulate, to just below $\frac{3}{4}$ the lip, parabolic, thickened, and somewhat elevated in front. **Column** 1.2 cm long including the 8 mm-long foot; anther bed papillose, pollinia 4, with saddle-shaped viscidium.

Epiphytic in premontane and lower montane rain forests at 1000–1500 m. Costa Rica south to

Venezuela and Ecuador. Flowering April to September. Reports from Nicaragua are most likely based on *M. pachyacron*.

Maxillaria reichenheimiana is readily distinguished from *M. pachyacron* by its broad, usually emarginate leaves with white spots. The flowers of both species are remarkably similar, but the sepals of *M. reichenheimiana* are usually shorter, and the column foot is distinctly longer. Both species are sympatric over parts of the range, e.g., at Monteverde, Costa Rica. Both species are isolated phenologically because *M. pachyacron* flowers from October to March.

Maxillaria ringens Rehb. f., Ann. Bot. Syst. 6: 523. 1863. TYPE: Costa Rica, *Endres* 8 (lectotype selected here: w). ?*M. yzabalana* S. Watson, Proc. Amer. Acad. Arts 23:266. 1888. *M. tuerckheimii* Schltr., Repert. Spec. Nov. Regni Veg. 10:295–296. 1912. TYPE: Guatemala, Cubilguitz, von *Türkheim* 790 (drawing of type: AMES). *M. rouseauae* Schltr., Beih. Bot. Centralbl. 36(2):413–414. 1918. TYPE: Panama, “Im Gebiete des Panama-Kanals,” *Rouseauu s.n.*, *Powell* 115 (neotype selected here: MO 955962). *M. pubilabia* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:70–71. 1922. TYPE: Panama, “Auf Hügeln bei Panama City,” *Powell* 214 (lectotype: AMES; isolectotype: MO). *M. amparoana* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:54–55. 1923. TYPE: Costa Rica, Carillo, *Wercklé* 7. *M. lactea* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:233. 1923, not 1925. TYPE: Costa Rica, San Mateo, *Brenes* 143 (isotype: AMES). Figure 20A.

Plant an often densely caespitose epiphyte to about 50 cm tall. Roots to about 1 mm in diameter. **Pseudobulbs** ovoid, not much compressed laterally, rugose or sometimes furrowed, 3–6 cm long, 1.5–3 cm wide, subtended by nonfoliaceous sheaths lacking articulations and soon fragmenting with age, apex 1-foliate. **Leaves** with distinct, canaliculate petiole to 10 cm long; blade elliptic-oblong, carinate and somewhat glaucous beneath, 11.5–38 cm long, 2–4.5 cm wide, the apex bluntly acute to rounded. **Inflorescences** several per rhizome bract; scape 3–13 cm long, concealed by bracts; ovary with pedicel (1.2)2–3.7 cm long. **Flowers** white, the sepals yellow within, aging pinkish or tan; lip white with yellow callus, usually with purple veined lateral lobes and spots on midlobe. **Sepals** somewhat chartaceous and canaliculate, straight, oblong, with apex acute to obtuse or acuminate; dorsal 2.5–4 cm long, 4–6 mm wide; lateral sepals 2.7–4.2 cm long, 4.5–7 mm wide. **Petals** narrowly lanceolate, incurved, 2.5–4 cm long, 3–5 mm wide. **Lip** ovate in general outline, (0.9)1.1–1.5 cm long, (4)6–8.5 mm wide when spread, 3-lobate on the apical $\frac{1}{4}$; side lobes embracing the column, obtuse; midlobe

fleshy, warty, and suborbicular. **Column** stout, clavate, nearly straight, 6.5–8 mm long excluding foot or anther; foot 4–5.5 mm long; anther about 2 mm long, with a dorsal crest. **Capsule** ellipsoid, 3–4.5 cm long.

Epiphytic at (100)300–1600 m. Flowering August to November in Costa Rica, July to December in Panama, and June to September in Nicaragua to Mexico. Mexico to Panama with doubtful reports from Colombia (probably *M. brunnea* Linden & Rehb.f.).

Maxillaria ringens is here interpreted as a variable species. It is characterized by the often large, caespitose plants with strongly fragrant clusters of white flowers with narrow segments. Schlechter recognized various entities based on scape length, the presence or absence of hairs on the lip, and flower color. Under apparently different cultural conditions, singular clones at Selby Gardens sometimes exhibit the long scapes of *M. ringens* or the short scapes of *M. amparoana*. Finding hairs on the lip probably depends on the quality of the microscope because they were observed in virtually all rehydrated flowers ($n = 10$) broadly sampled among available specimens. Flower color ages pinkish or tan, and color descriptions by collectors are by no means uniform. In Costa Rica, live specimens collected from upper elevations are somewhat smaller, have smoother pseudobulbs, and may be different. One specimen at CR (*Robinson & Vaughn* 1243) with somewhat larger flowers and long scapes had flowered in April and may be *M. fuerstenbergiana* Schltr., a species unknown from Central America.

There has been some confusion concerning the application of the name *M. ringens*. Reichenbach's original description indicates “labello sepalis ter brevior,” or lip one-third as long as (three times shorter than) the sepals. This phrase excludes *M. brunnea*, in which the lip is at least half as long as the sepals.

Although no original materials were found of *M. rouseauae*, the designated neotype is so identified by Schlechter.

Maxillaria rodrigueziana Atwood & Mora-Retana, Icon. Pl. Trop. 14: t. 1361. 1989. TYPE: Panama, El Cope, *T. Antonio* 2137 (holotype: MO; isotype: SEL). Figure 23A.

Plant a large, caespitose epiphyte, to 35 cm high. Roots white, to 1 mm in diameter. **Pseudobulbs** ovoid, rugose, 1-foliate, 4–5 cm long and 3–4 cm wide, subtended and often hidden from view by the inflated blade-bearing rhizome bract base, which is usually abruptly

narrowed at the articulation. **Leaf** blades coriaceous, elliptic, obtuse to rounded, 18–30 cm long, 4.5–8 cm wide, supported by a long petiole 5–15 cm long. **Inflorescences** 14–20 cm tall, mostly hidden by 4–7 inrolled, obtuse bracts 2–6.5 cm long; ovary with pedicel about 2.5 cm long, concealed by the conspicuous, conduplicate, acute floral bract 5–8 cm long. **Flowers** creamy white, fragrant, the sepals turning greenish toward the apex, lip base white, apically yellow, and lined on the sides with red. **Sepals** long attenuate, 12–16 cm long with the dorsal slightly shorter than the lateral sepals, 1.0–1.3 cm wide at the base. **Petals** long-attenuate, 10–14 cm long, 7–9 mm wide at the base. **Lip** ovate, 3-lobate on the apical $\frac{1}{4}$, about 2 cm long and 1.5 cm wide; midlobe broadly rounded and somewhat reflexed; lateral lobes folded and embracing the column; callus ligulate, puberulent, to about the $\frac{1}{2}$ the lip. **Column** cylindric, about 1.5–1.8 cm long, forming a foot 8 mm long at the base; pollinia 4, lacking a stipe but supported on a saddle-shaped viscidium.

Large and apparently rare epiphyte in evergreen forests at 700–750 m. Flowering June, October, and November. Costa Rica and Panama.

This species is one of the most spectacular Central American maxillarias and is unique for its sheer size. It is easily distinguished from its South American sister species, *M. speciosa* Rehb. f., by the more leathery flowers and by the spotting on the sepals and petals restricted to the lower half. The midlobe of the lip is less than a quarter the lip length in this species and nearly half the lip length in *M. speciosa*. One might regard it as a subspecies of *M. speciosa*, but the consistently different features mentioned argue for recognition of two distinct species. According to R. L. Dressler, *M. rodrigueziana* has a heavy fragrance of cheap perfume that is a bit much in close quarters.

Maxillaria sanguinea Rolfe, Bull. Misc. Inform. 1895:8. TYPE: Panama, Chiriquí, *James O'Brien* s.n. (holotype: K). Figure 10E.

Plant epiphytic with short to somewhat elongate rhizomes forming large clumps. Roots white, to 1.5 mm in diameter. **Pseudobulbs** 0.5–4 cm apart, fusiform-ellipsoid, apically 1-foliate, usually tapering at both ends, 1–2.5 cm long, 0.5–1.3 cm broad. **Leaves** linear, 20–35 cm long and 2–3.5 mm wide. **Inflorescence** 1 per rhizome bract on the rhizome of the most recently completed shoots; scapes about 1 cm long, nearly concealed by the rhizome bract and covered by scape bracts; ovary with pedicel 2–3.5 cm long. **Flowers** slightly fragrant, the perianth greenish with strong overlay of red, lip flushed with red, apically white; callus maroon. **Sepals** oblong-elliptic, 1.8–2.7 cm long, 4–9 mm wide, the lateral sepals forming a mentum around the column foot. **Petals** somewhat falcate and arcuate, 1.5–2.3 cm long, 3.5–7 mm wide. **Lip** obovate, apically obtuse to truncate, laterally constricted on the apical $\frac{1}{4}$, rendering it somewhat 3-lobate, 1.5–2.0 cm long, 6.5–9.5 mm wide;

callus ligulate on the lower $\frac{1}{2}$, apically recurved, truncate. **Column** arcuate, 1.1–1.5 cm long; anther cap papillose; pollinia 4, supported on a saddle-shaped viscidium.

Epiphyte of larger branches in lowland tropical and premontane rain forests at 10–900 m. Flowering January and February. Costa Rica and western Panama; erroneously reported from Florida (USA), apparently on the basis of a specimen planted in the wild (fide J. Beckner, pers. comm.).

Maxillaria sanguinea is similar to *M. tenuifolia*, which it replaces geographically. The latter species, ranging from Mexico to Nicaragua, flowers from March to May, while *M. sanguinea* flowers in January and February. The flowers of *M. tenuifolia* have a pronounced fragrance resembling coconut (or crayons), whereas *M. sanguinea* has a slightly fruity fragrance. The lip apex is broader in *M. sanguinea* and is usually white, at least apically, and only minutely spotted (peppered). The lip apex of *M. tenuifolia* is always conspicuously spotted with a few large blotches. Vegetatively, *M. sanguinea* usually has fusiform pseudobulbs, while those of *M. tenuifolia* are usually cylindric. The leaves of *M. sanguinea* rarely exceed 3 mm wide, and the leaf width of *M. tenuifolia* rarely measures less than 3 mm.

Maxillaria schistostele Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:303–304. 1923. TYPE: Costa Rica, near San Ramón, *Acosta* s.n. (photo of type: AMES).

Plant a somewhat spreading, ascending epiphyte; rhizomes 4–5 mm in diameter, the segments about 1.5 cm between pseudobulbs. **Pseudobulbs** ovoid or oblong, 1–1.3 cm long, subtended by nonfoliaceous sheaths, the apex 1-foliate. **Leaves** linear-ligulate, 6–9 cm long, 6–8 mm wide, the base somewhat narrowed, apex obtuse and emarginate. **Inflorescence** slender, borne at the pseudobulb base; scape 6–8 cm long; ovary with pedicel about 1.3 cm long, somewhat exceeded by the floral bract. **Flowers** rigid in dried specimens, glabrous except for the lip; color unknown. **Sepals** linear or linear lanceolate, 2.2 cm long; lateral sepals oblique, forming with the column foot an obtuse, shortly conic mentum. **Petals** linear, acuminate, 1.6 cm long. **Lip** minutely papillose, 1.25 cm long including the distinct claw (2.5 mm long) at the base; forming an abruptly lanceolate blade 1 cm long, 5 mm wide; callus at the base obovate, obtusely sulcate. **Column** arcuate, 6 mm long, the apex thickened, the anther bed with fimbriate margin; foot at the base 2 mm long.

Maxillaria schistostele is known only by a photograph of the type collection but is clearly related to the *M. acuminata* complex in South America,

a group characterized by the rhizomatous habit, usually 2-foliate pseudobulbs (1-foliate in this species), wiry scapes, and entire lips. Nothing is known of its ecology or phenology. The above description is translated and condensed from Schlechter's original description.

Maxillaria schlechteriana J. T. Atwood, Lindleyana 9:231. 1994. Basionym: *Camaridium imbricatum* Schltr., Beih. Bot. Centralbl. 36:415–416. 1918. TYPE: Costa Rica, La Palma, *Wercle* (isotype: AMES). *Ornithidium schlechterianum* C. Schweinf., nom. illeg., Bot. Mus. Leafl. 4:94. 1937. *Maxillaria wrightii* (Schltr.) Ames & Correll var. *imbricata* (Schltr.) Ames & Correll, Bot. Mus. Leafl. 11:18. 1943. Not *Maxillaria imbricata* Barb. Rodr. Figure 14A.

Plant a straggly, erect to pendent, cane-forming epiphyte to about 50 cm tall; shoot slender, terminated by a pseudobulb, to 30 cm long; rhizome wiry, concealed by scales when young, apparently turning black with age. Roots white, to 1 mm in diameter. **Pseudobulbs** compressed, ovoid to suborbicular, 1–3 cm long, mostly concealed at the base by foliaceous sheaths, apically 1-foliate. **Leaves** with petiole broadened below the articulation and about $\frac{1}{4}$ – $\frac{1}{2}$ the blade length; blade elliptic-lanceolate, carinate beneath, 2.5–18 cm long, 8–40 mm wide, acute to obtuse. **Inflorescence** 1 per nonfoliaceous bract axil, forming on the developing shoot; scapes to about 2 cm long; ovary with pedicel 3.5–6 mm long, subtended by a somewhat cucullate floral bract 7–11 mm long. **Flowers** white or light lavender to rose; column often darker. **Sepals** similar, oblong, acute; dorsal 1.2–1.5 cm long, 4 mm wide; lateral sepals somewhat oblique, 1.25–1.5 cm long, 4–5 mm wide. **Petals** oblong, 1–1.4 cm long, about 3 mm wide, acute. **Lip** rigid with the column foot, lateral view somewhat sigmoid but base not saccate, 6–8 mm long in natural position; lateral lobes extending to $\frac{2}{3}$ the lip; midlobe fleshy; callus tongue-like between the lateral lobes. **Column** 2.5–3 mm long without anther; anther about 1 mm long; pollinia 4, with somewhat square stipe. **Capsule** ellipsoid to globose, about 1 cm long.

Epiphytic and terrestrial in montane cloud forests at (1000)1400–2800 m. Flowering August to March. Costa Rica and Panama; doubtfully reported from Nicaragua as *M. wrightii* var. *imbricata*.

This species is most similar to *M. paleata* (Rchb. f.) Ames & Correll, with which it is often sympatric. However, that species has larger, darker, red-purple flowers with a lower column-to-lip-length ratio. Also, the profile of the lip is somewhat different. Among herbarium specimens, no intermediates suggesting hybrids have been seen.

Maxillaria scorpioidea Kraenzl., Svensk. Vet. Akad. Handl. 46:71. 1911. TYPE: Brazil, Matto Grosso. ?*Maxillaria rhodosticta* Kraenzl., Rept. Spec. Nov. Regni Veg. 24:223. 1928. TYPE: Mexico. Figure 8D.

Plant a straggly epiphyte, or if caespitose consisting of several ascending successively borne shoots to 2(3) cm apart. Roots white, to 1 mm in diameter. **Pseudobulbs** narrowly ovoid 2–5 cm long, 1–1.7 cm wide, compressed, conspicuously ribbed when dried, subtended by 1–2 leaf-bearing rhizome bracts, apically (1)2–3-foliate. **Leaf** blades linear to very narrowly elliptic, 2–24 cm long, 6–15 mm wide. **Inflorescence** 1 per rhizome bract axil; scapes 1–2 cm long, concealed by 2 or more acute, somewhat inflated bracts; ovary with pedicel 1.6–2 cm long, subtended by a pair of glumaceous bracts, the uppermost 16–21 mm long. **Flowers** greenish, yellowish, or buff, lip with maroon spots on the margins, often tipped with maroon. **Sepals** similar; dorsal narrowly lance-elliptic, acute, apically and dorsally carinate, 18–25 mm long, to 5 mm wide; lateral sepals the same size, lanceolate, acute. **Petals** narrowly elliptic, falcate, 16–22 mm long, 2.5–4 mm wide. **Lip** arcuate, narrowly elliptic, 15–18 mm long, the apex thickened, oily; callus linear, oily to just below the middle. **Column** slender, somewhat arcuate, 12–14 mm long; foot 2 mm long; pollinia 4, with elongate stipe and saddle-shaped viscidium. **Capsule** somewhat down-curved, ellipsoid, 2–3 cm long including the beak.

Epiphytic in moist forests at 500–1800 m. Flowering mostly November to March. Mexico (southern Chiapas) to western El Salvador, Costa Rica and western Panama, and Brazil and Ecuador. In Central America this species is known only from the Pacific drainage.

The identification of the name is based on the original description with illustration showing consistent floral dimensions and color. The name *M. rhodosticta* probably applies to this species because the original description indicates nearly exact floral dimensions and the spotting on the lip margin. *Maxillaria scorpioidea* has for more than a century caused confusion with *M. friedrichsthalii* Rchb. f. and *M. aciantha* Rchb. f. because its floral size is intermediate between the other two. The close spacing of the shoots and spotting pattern on the lip margin are usually good features for field recognition. One should look at column length (excluding the foot), which is shorter in *M. friedrichsthalii* and longer in *M. aciantha*. Floral size and color are usually closer to those of *M. friedrichsthalii* than *M. aciantha*, but, as with the latter species, *M. scorpioidea* has a much longer bract subtending the flower. Except perhaps in western Panama, *M. scorpioidea* is sympatric only with *M. friedrichsthalii* in its more northern range, and it probably does not

occur much below 500 m. In dried specimens *M. scorpioidea* often has a golden, waxy appearance that is lacking in the other two species.

Maxillaria serrulata Ames & Correll, Bot. Mus. Leaf. 11:16. 1943. *Camaridium amparoanum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 56–57. 1923. TYPE: Costa Rica, San Jeronimo, Wercklé 122 (drawing of type: AMES). *Ornithidium amparoanum* (Schltr.) Pabst, Bradea 2:87, 1976. Not *Maxillaria amparoana* Schltr. Figure 17A.

Plant a somewhat straggly, cane-forming epiphyte, to about 50 cm high; stems upright or pendent, each terminated by a pseudobulb; rhizome conspicuous, 2–10 cm long. Roots less than 1 mm in diameter. **Pseudobulbs** ovoid, 1.5–2.5 cm long, protected at the base by 1–3 leaf-bearing, rugose sheaths; apex 1-foliate. **Leaves** articulate, without petiole; blades ligulate, obtuse to emarginate, abaxially keeled and mucronate, to 13 cm long, 2.2 cm wide. **Inflorescences** appearing at the base of mature pseudobulbs with the flush of the new growth; scapes to about 3 cm long, concealed by compressed, subulate bracts; ovary with pedicel to 1 cm long, much exceeded by the subtending, acute floral bract to 3 cm long. **Flowers** dark red with some green within. **Sepals** similar, obovate, 2.5 cm long, 1.5 cm wide, obtuse; dorsal somewhat concave; lateral sepals somewhat oblique at the base. **Petals** obovate, 1.8–2 cm long, 9–11 mm wide. **Lip** complex, hinged to the column foot, 3-lobate below the middle, about 1 cm long, 8–9 mm across the midlobe; lateral lobes rounded and erect around the column; midlobe suborbicular, with a dentate margin; callus of about 7 keels higher at the base and becoming lower apically. **Column** arcuate, 8 mm long excluding the anther; anther 1.5 mm in diameter; foot 3 mm long.

Probably epiphytic but poorly known ecologically; 1400–2000 m. Flowering July and August. Endemic to Costa Rica.

It is easily distinguished by the dark red flowers and serrulate lip but is poorly known despite the handsome flowers. It seems to be related to other species, including *M. sigmoidea*, but little is known of some aspects of the plant, e.g., whether the petioles of the foliaceous rhizome bracts are abruptly narrowed.

Maxillaria sigmoidea (C. Schweinf.) Ames & Correll, Bot. Mus. Leaf. 11:16. 1943. *Ornithidium sigmoideum* C. Schweinf., Bot. Mus. Leaf. 4: 121–122. 1937. TYPE: Costa Rica, Cerro Gallito, Valerio 72 (holotype: AMES). Figure 13D.

Plant somewhat straggly, epiphytic, or terrestrial, erect or pendent when large, to about 1 m long; stems elongate, often branched, each shoot to 30 cm long and terminated by a pseudobulb. Roots white, to 1 mm in

diameter. **Pseudobulbs** ovoid to suborbicular, 1–4 cm long and the uppermost strongly reduced, usually concealed by 1–3 foliaceous sheaths, apically 1-foliate. **Leaves** with petiole up to about $\frac{1}{3}$ the blade length; blade oblong-elliptic, keeled abaxially, 6–27 cm long, 1.5–5.5 cm wide, much reduced in distal shoots; apex acute, acuminate, or somewhat attenuate. **Inflorescences** a single-flowered scape borne singly within nonfoliaceous, scarious, acute sheaths of the developing shoot; scape to 5 cm long; ovary with pedicel 1–1.5 cm long subtended by a somewhat membranaceous, cucullate, acute bract 1.5–2.1 cm long. **Flowers** light pink to lavender with white lip striped with lavender; column often yellowish apically. **Sepals** similar, lanceolate-elliptic, the lateral somewhat oblique, 1.8–2.4 cm long, 6–8 mm wide, acute or shortly acuminate. **Petals** elliptic-oblancoate, 2–2.2 cm long, 5–5.5 mm wide, acute. **Lip** complex for the genus, rigid with the column foot, forming a deeply saccate base, the apical $\frac{3}{4}$ sharply reflexed and appearing sigmoid laterally, 9–13 mm long, to 6 mm wide with the lateral lobes spread; lateral lobes falcate, diverging near the upper third, embracing the column apex; midlobe ovate, thickened apically; callus fleshy, continuous with the lateral lobes, rounded to somewhat 3-dentate in front, exceeding the sinuses between lobes. **Column** cylindric, somewhat arcuate, broadened above, 8–12 mm long; with short foot to about 2 mm long at the base; anther shortly beaked; with protruding viscidium; pollinia 4. **Capsule** 1.5 cm long.

A plant of windy cloud forests at 1400–2100 m. Flowering October to December and February to April. Costa Rica and Panama.

The unmistakable sigmoid appearance of the lip is unique among Costa Rican *Maxillaria*; otherwise the flowers appear similar to those of a large *M. schlechteriana* J. T. Atwood or a small *M. vaginalis* Rchb. f.

Maxillaria strumata (Endres & Rchb. f.) Ames & Correll, Bot. Mus. Leaf. 11:17. 1943. *Ornithidium strumatum* Endres & Rchb. f., Gard. Chron. 2:772. 1874. TYPE: Costa Rica, Endres 281 (holotype: w; isotype: AMES). *Sepalosaccus strumatum* (Endr. & Rchb. f.) Garay, Caldasia 8:525. 1962. *Sepalosaccus humilis* Schltr. Repert. Spec. Nov. Regni Veg. Beih. 19:244–246. 1923. TYPE: Costa Rica, San Pedro de San Ramón, Brenes 130 (lectotype: AMES). Figure 19B.

Plant a densely caespitose epiphyte to about 6 m tall. Roots filiform, < 0.5 mm in diameter. **Pseudobulbs** approximate, narrowly ovoid to cylindric, to about 5 cm tall, 6 mm wide, subtended when young by 1–2 foliaceous bracts, the apex 1-foliate. **Leaf** blades thin, narrowly elliptic to oblong, obtuse, to 5.5 cm long, 8 mm wide, the apical leaf shortly petiolate. **Inflorescence** 1 per nonfoliaceous bract axil of the rhizome, to about 1.5 cm long; ovary with pedicel 4.5–6 mm long, exceeded by the subtending acuminate floral bract. **Flowers** white, lip apex yellow, anther dark purple. **Sepals** dissimilar;

dorsal oblong, concave at the base, recurved at the obtuse apex, 4–5 mm long, about 1.2 mm wide; lateral sepals about $\frac{3}{4}$ connate, each oblong, 7–8 mm long. **Petals** oblong, 4–4.5 mm long, 1–1.2 mm wide, obtuse. **Lip** subsaccate and continuous with the column foot, somewhat 3-lobate on the apical $\frac{1}{2}$, about 4.5–5 mm long when spread; lateral lobes broadly rounded and embracing the column, connected at the apex by a transverse tongue-like callus; midlobe ovate, somewhat constricted below the base, with recurved margins, obtuse. **Column** stout, about 2 mm long excluding the anther; foot about 2.5 mm long, anther about 1 mm in diameter.

Epiphytic in wet forests; the type locality is 1100 m. Flowering at least September; in cultivation at Selby Gardens, it flowers at various times of the year.

Maxillaria strumata is related to the *M. neglecta* group but has a much more caespitose plant habit. It is little collected, probably because of its small size, but has been collected by R. L. Dressler at “low” elevation near San Joaquín de Dota.

Maxillaria suaveolens Barringer, *Brittonia* 37(1): 44–46. 1985. TYPE: Costa Rica, Puntarenas, Esquinas forest, area between the Rio Esquinas and Palmar, *P. H. Allen 5323* (holotype: F; Isotypes: MO, NY, SEL). Figure 14C.

Plant known only from the type, epiphytic, somewhat repent or apparently pendulous; shoots developing 4–8 cm apart. Roots to 1 mm in diameter. **Pseudobulbs** apically 1-foliate, somewhat compressed, ovoid, 3.5–5 cm long, and perhaps 2 cm wide in live material, mostly hidden when young by 2–4 subtending leaves. **Leaves** subcoriaceous, oblong to narrowly obovate, shortly petiolate; blade 10–17 cm long and 3–5 cm wide, retuse. **Inflorescences** 1–few per rhizome bract axil of immature shoots, each 5–7 cm long, covered with about 5 inflated, acute bracts; ovary with pedicel enclosed in the uppermost bract before pollination, 1.8–2.0 cm long. **Flowers** fragrant, white with butter yellow lip. **Sepals** elliptic-obovate, 4–5 cm long, 1.8(–2.3) cm wide, acute. **Petals** elliptic-obovate, 3.7–4 cm long, 1.5–2 cm wide, acute to obtuse. **Lip** hinged to the column foot, about 1.5–2 cm long, 3-lobate above the middle; callus on the lower half ligulate; midlobe about 6 mm long, ovate. **Column** arcuate, 1 cm long; foot about 5 mm long.

“Epiphytic in tops of large trees” at less than 50 m. Flowering September. Costa Rica; known only from the type collection.

The large, fragrant (Allen compared its fragrance to that of narcissus), and attractive flower, which should be conspicuous to collectors, suggest that this is a rare species, but the plant is probably a crown epiphyte where orchids are unseen except in felled forests or branch falls. Also, the plant may rarely be in flower and thus over-

looked by collectors if the flowers last only 3 days, as indicated on the herbarium label. More field collections, including liquid-preserved flowers and observations on growth habit, are badly needed. Floral dimensions are taken from one rehydrated flower and from the original description.

Maxillaria tenuifolia Lindl., Edwards’s Bot. Reg. 23: sub. t. 1886. 1837. TYPE: Mexico, Veracruz, Hartweg. ?*Maxillaria gracilifolia* Kraenzl., Mitt. Inst. Allg. Bot. Hamburg 6:420. 1927. Figure 10D.

Plant a densely clumping epiphyte to about 75 cm across, comprised of numerous decumbent to pendent shoots 1–8 cm apart. Roots white, to 1.5 mm in diameter. **Pseudobulbs** cylindric to fusiform, somewhat compressed, 2–5 cm long, 1–2 cm wide, subtended by bladeless rhizome bracts, or if with blades these falling at maturity, the apex 1-foliate. **Leaves** linear, 15–50 cm long, 3–8 mm wide. **Inflorescence** 1 per rhizome bract of mature shoots, 1–2 cm long, covered by acute sheaths and subtending rhizome bract; ovary with pedicel 3–4 cm long, much longer than the subtending bract. **Flowers** variously blood red, purple-red, or yellowish spotted with red, the lip yellow or white spotted with red, fragrant, similar to that of coconut (crayons?). **Sepals** lanceolate-ovate, 2–3 cm long, 6–9 mm wide. **Petals** elliptic-lanceolate, somewhat falcate, apical margins erose, 1.9–2.7 cm long, 5–8 mm wide. **Lip** simple, elliptic, constricted on the apical $\frac{1}{4}$, forming a reflexed apex; callus on the lower $\frac{1}{2}$ or just above, oblong, thickened and rounded in front, thickened on the sides. **Column** arcuate, 1–1.3 cm long; foot 2 mm long. **Capsule** ellipsoid, 3–4 cm long.

Large clumping to distinctly rhizomatous epiphyte of larger trunks and branches in (semi-)evergreen forests at 100–1200 m. Flowering March to May. Mexico (Campeche, Chiapas, San Luis Potosí, Yucatán, and Veracruz) to Costa Rica.

Maxillaria tenuifolia is replaced geographically in central Costa Rica by *M. sanguinea*, which flowers in January and February, lacks the strong fragrance of *M. tenuifolia*, and usually has narrower leaves.

Maxillaria tigrina C. Schweinf., Amer. Orch. Soc. Bull. 37:409–410. 1968. TYPE: Costa Rica, Province of Heredia, *R. T. Northen s.n.* (holotype: AMES). *Chrysocynis tigrinum* (C. Schweinf.) Atwood, Icon. Pl. Trop. 14: t. 1306. 1989. Figure 11B.

Plant a straggly, partially pendent epiphyte; shoots 4–7 cm apart. Roots small, white, to 0.5 mm in diameter. **Pseudobulbs** cylindric, subtended by non-blade-bearing sheaths, apically 1-foliate, 2–3 cm long. **Leaves** coria-

ceous, elliptic, the petiole 1–2.5 cm long; blade 5–10 cm long, 1–2 cm wide, sulcate along the midvein and keeled beneath. **Inflorescence** 1 per rhizome bract axil, 1.5–2 cm long, borne on the rhizome; ovary with pedicel 1.5 cm long, slightly shorter than the subtending, inflated, acute floral bract. **Flowers** leathery, translucent brownish, lined with purple. **Sepals** similar; dorsal lance-elliptic, concave, 2.6 cm long, 8 mm wide, acute; lateral sepals lance-ovate, reflexed near the base, cuspidate apically, 2.4 cm long, 1 cm wide, acute. **Petals** elliptic-ovate, 2.4 cm long, 9 mm wide, acute. **Lip** 3-lobate, glabrous, 1.8 cm long; lateral lobes acute, spreading; midlobe triangular, twice as long as the base; callus transverse, ridgelike, terminating between the lateral lobes. **Column** arcuate, to 8 mm long; pollinia 4, with squarrose stipe and saddle-shaped viscidium.

Epiphytic in montane cloud forests at 1900–2000 m. Flowering July. Costa Rica and Panama.

The arcuate column, unique 3-lobate lip, and plant habit, as well as general floral shape, are features more consistent with South American *Chrysocynis*. The lip is glabrous, the lateral lobes more acute, and the column shorter than in the South American species, but the plant habit as well as major floral features are those of *Chrysocynis*. Cladistic analyses based on DNA studies are needed to resolve this question.

Maxillaria tonduzii (Schltr.) Ames & Correll, Bot. Mus. Leaflet. 11:17. 1943. *Camaridium costaricense* Schltr., Repert. Spec. Nov. Regni Veg. 3:250. 1907. TYPE: Costa Rica, La Palma, *Tonduz 12429* (isotypes: US 577589, 815052, 815053; drawing of type: AMES). *Camaridium tonduzii* Schltr., Repert. Spec. Nov. Regni Veg. 8:571. 1910. TYPE: Costa Rica, *Tonduz 12429* (same collection as for *Camaridium costaricense* Schltr.). *Maxillaria heidelbergensis* Senghas, nom. illeg. Orchidaceae (ed. 3) 29:1751. 1994. Figure 4C.

Plant an erect or decumbent, apparently monopodial epiphyte to about 2 m tall lacking pseudobulbs; stems occasionally branched, sometimes fasciculately so, with each branch arising nearly parallel with the main stem, concealed by the somewhat rugose leaf sheaths. Roots white, to about 1 mm in diameter. **Leaf** blades above the articulation ligulate, 2–13 cm long, 5–15 mm wide; apex rounded to unequally 2-lobate. **Inflorescence** 1–3 per leaf axil, shorter than the subtending leaf; scapes to about 5 cm long; ovary with pedicel (7)10–11 mm long, subtended by a hyaline, acute floral bract 1.3–1.7 cm long. **Flowers** brick red or green stained with reddish brown; lip white with purple spots. **Sepals** somewhat canaliculate, lanceolate, 1.7–2.3(3.7?) cm long, (3.5)4–5 mm wide, acute; lateral sepals somewhat oblique. **Petals** linear-lanceolate, 1.4–1.9 cm long, 2.5–3.5 mm wide, acute. **Lip** hinged to the column foot, arcuate in natural position, 3-lobate above the middle, 7–9.5 mm long,

6.5–9 mm wide when spread; lateral lobes somewhat clasping the column, the apex forming nearly a right angle; midlobe somewhat flared, rounded in front; callus ligulate from near the base to just above the middle, elevated in front, with several sharp teeth at the base that in some specimens seem to form more or less into 3 rows. **Column** stout, somewhat arcuate, 5–6 mm long excluding the anther; foot 3 mm long; anther 1 mm long, verrucose.

Epiphytic and terrestrial in montane rain forests at 1300–1650 m. Flowering season incompletely known; at least August, October, February, and March. Apparently endemic to Costa Rica, although similar plants have been collected in adjacent Panama with more attenuate sepals and petals.

Maxillaria tonduzii is unique for its tall canes and brick red flowers with purple-spotted, white lip.

Maxillaria trilobata Ames & C. Schweinf., Bot. Mus. Leaflet. Harvard Univ. 11:17. 1943. *Camaridium brenesii* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:237. 1923. TYPE: Costa Rica, San Ramón, *Brenes 233* (photo of type: AMES). Figure 3D.

Plant a large epiphyte with apparently monopodial canes (adults) to 1 m long. Roots white, to about 1 mm in diameter. **Pseudobulbs** lacking in adults but possibly present in unknown juveniles. **Leaves** supported on elongate, tapering sheaths to about 15 cm long including the petiole above the oblique articulation; blade subcoriaceous, 10–25 cm long, 4–6 cm wide; apex rounded to acute. **Inflorescences** several per leaf axil; scapes about 8 cm long, covered by membranaceous, acute bracts; ovary with pedicel 7–10 mm long, exceeded by the subtending inflated bract. **Flowers** small, white with yellow and red on lip. **Sepals** oblong-ovate, 1.2–1.8 cm long, 5–7 mm wide. **Petals** elliptic-oblancheolate, 1–1.5 cm long, to 6 mm wide, acute. **Lip** articulated to the column foot, deeply 3-lobate on the apical $\frac{1}{3}$, 9–10 mm long, 9–10 mm wide; callus ligulate on the lower $\frac{1}{2}$. **Column** cylindric, 3–5 mm long, extended at the base into a foot 1 mm long. **Capsule** obovoid, about 2–2.5 cm long.

A large epiphyte in cloud forests at 1000–1700 m. Flowering November to May. Costa Rica and Panama.

Maxillaria trilobata is vegetatively similar to *M. inaudita* Rchb. f. in the long, petiolate leaves but has much smaller flowers with a deeply 3-lobate lip. The drawing in the Ames herbarium of the type showing the long, tapering petioles and small flowers with a deeply 3-lobate lip leaves little doubt as to the identity.

Maxillaria tubercularis J. T. Atwood, Lindleyana 9:229–231. 1994. TYPE: Panama, Chiriquí, Fortuna Dam region, along trail to Cerro Hornito, *McPherson 13567* (holotype: MO). Figure 8A.

Plant a conspicuously rhizomatous epiphyte to about 50 cm tall; stems erect when young, pendent when large, rooted at the base, concealed by tuberculate, nonfoliaceous bracts. Roots to about 1 mm in diameter. **Pseudobulbs** ovoid, compressed, 2.5–5 cm long, 1–2.25 cm wide, 3–10 cm apart, concealed when young by 2–3 tuberculate, foliaceous sheaths, the apex 1-foliate. **Leaves** with petiole $\frac{1}{6}$ – $\frac{1}{3}$ the blade length, the lateral width 3–4 mm; blade coriaceous, narrowly elliptic, 6–15 cm long, 1–3 cm wide; apex acute. **Inflorescences** apparently restricted to nonfoliaceous bract axils of the mature or immature rhizome; scapes less than 2 cm long; ovary with pedicel 1.3–1.6 cm long, subtended by a subequal, inflated, acuminate floral bract. **Flowers** well expanded, yellow with many red to maroon spots; lip red or maroon. **Sepals** dissimilar, ovate, acute; dorsal somewhat concave, 1.9–2.2 cm long, 8.5–14 mm wide; lateral sepals attached to the column foot, 1.8–2.2 cm long, 1.2 cm wide. **Petals** elliptic-ovate, somewhat oblique, 1.5–1.7 cm long, 6–7 mm wide, acute to obtuse. **Lip** not firmly attached to the column foot, ovate in general outline when spread, 1.2–1.3 cm long, 9–10 mm wide, 3-lobate at about the middle; lateral lobes variable, acute to rounded, somewhat exceeded in front by the fleshy, subquadrate, emarginate callus; midlobe ovate, rounded, with crenulate margin. **Column** arcuate, about 9 mm long excluding foot and anther, foot 5–6 mm long. **Capsule** ellipsoid, 3-lobate.

Epiphytic in evergreen (often oak) forests at 1300–2700 m. Flowering August, December, and January. Endemic to southern Costa Rica and Chiriquí, Panama.

Maxillaria tubercularis most closely resembles *M. elatior*, found to the north, but is generally smaller in all vegetative parts and occurs at much higher elevations.

Maxillaria umbratilis L. O. Williams, Ann. Missouri Bot. Gard. 28:425. 1941. *Camaridium nutantiflorum* Schltr., Beih. Bot. Centralbl. 36, Abt. 2:417. 1918. TYPE: Costa Rica, La Palma, *C. Wercklé* (isotype: CR). *Camaridium vinosum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 240. 1923. TYPE: Costa Rica, San Ramón, *A. M. Brenes 234* (lectotype: CR; isoelectotypes: AMES, NY). *Maxillaria vinosa* (Schltr.) Senghas, Orchidaceen (ed. 3) 29:1751. 1994. Not *Maxillaria nutantiflora* Schltr. Not *Camaridium vinosum* Rolfe. Figure 15A.

Plant a subshrub to about 1 m tall, of 1 or more canelike shoots, each 10–30 cm long, terminating in a

pseudobulb and forming at the base of the previously developed pseudobulb. Roots white, to 2 mm in diameter. **Pseudobulbs** ovoid, biconvex, 3.5–5 cm long, 1(2)-foliate, with 2–5 blade-forming rhizome bracts at the base. **Leaves** coriaceous, petiolate including the rhizome bracts (early deciduous), the blade narrowly elliptic-lanceolate, to about 20 cm long, 2 cm wide, the apex obtuse and often retuse. **Inflorescence** 1 per axil of the half-lyre-shaped rhizome bract of the developing shoot; scapes ≥ 4 cm long, covered by acute sheaths; ovary with pedicel 10–13 mm long, subtended and exceeded by a cucullate floral bract 15–21 mm long. **Flowers** variously colored, yellowish green, greenish white to orange, suffused with red or entirely red, the lip often with red. **Sepals** similar, lanceolate, concave, 19–21 mm long, 4.5–5 mm wide, acute. **Petals** elliptic, attenuate toward both base and apex, 16–20 mm long, 5–6 mm wide. **Lip** hinged to the column foot, deeply 3-lobate, 10 mm long, 10 mm wide; lateral lobes spreading, falcate; midlobe triangular, acute, 5–6 mm long, with a fleshy V-shaped callus on the lower $\frac{1}{4}$. **Column** stout, arcuate, 4–5 mm long; foot at the base 2.5–3 mm long. **Capsule** ellipsoid, about 2.5 cm long.

Epiphyte of wet forests or terrestrial on mossy embankments, especially road cuts at 1000–2800 m. Flowering January to April, July to October, and perhaps throughout the year. Costa Rica and Panama.

Maxillaria umbratilis is unique among species that produce half-lyre-shaped rhizome bracts in the flush of new growth by the smaller, rather dull-colored flowers with narrow floral segments. The basis for the understanding of *Camaridium nutantiflorum* is the original description and the floral diagnosis by Schlechter (Repert. Spec. Nov. Regni Veg. Beih. 59: t. 68 No. 271. 1931), which shows the callus rather poorly rehydrated. Actually, the callus is more V-shaped in front than shown by his drawing, but when pressed the tips of the V tend to point forward. A rehydrated flower from *Brenes 234* shows the same type of callus. Schlechter recognized *C. vinosum* on the basis of the smaller size and the odd and probably abnormal inflexed lip apex, but there seems to be a continuum between the types. The dark flower color indicated by Brenes is probably based on either aged flowers, a color form, or perhaps plants in an unusually exposed location.

Maxillaria uncata Lindl., Edwards's Bot. Reg. 23: sub t. 1886. 1837. TYPE: Guiana, *Loddiges s.n.* (holotype: K). *Camaridium uncatum* (Lindl.) Hoehne, Arq. Bot. Est. Sao Paulo 6: 127. 1952. *Maxillaria macleei* Bateman ex Lindl., Edwards's Bot. Reg. 26: misc. 70. 1840. TYPE: Guatemala. *Maxillaria nana* J. D. Hook., Ic. Pl. t. 315. 1841. TYPE: Guiana, C.

S. Parker, *Maxillaria squamata* Barb. Rodr., Gen. & Sp. Orch. Nov. 1:118. 1877. TYPE: Brazil (illustration in Flora Brasiliensis 3(6): t. 24). *Ornithidium squamatum* (Barb. Rodr.) Barb. Rodr., Gen. & Sp. Orch. Nov. 2:209. 1882. *Camaridium squamatum* (Barb. Rodr.) Hoehne, Arq. Bot. Est. Sao Paulo 2:72. 1947. *Maxillaria stenostele* Schltr., Beih. Bot. Centralbl. 36, Abt. 2:414. 1918. TYPE: Costa Rica, Rio Sucio, *F. C. Lehmann 1236* (holotype: B, destroyed). *Maxillaria striatella* Kraenzl., Repert. Spec. Nov. Regni Veg. 24:359. 1928. TYPE: Guatemala. Figure 10C.

Plant variable in habit, usually repent with shoots 1 or more cm apart or cespitose with shoots approximate, or appearing cespitose with many ascending shoots each spaced 1 or more cm apart. Roots to 1 mm in diameter. **Pseudobulbs** cylindric, apically 1-foliate, about 1 cm long, concealed by scaly rhizome bracts. **Leaves** variable, even in the same shoot, always fleshy, flat to terete, narrowly elliptic to oblong or linear, acute, 1.5–6 (or more) cm long, 2–6 mm wide. **Inflorescence** 1 per rhizome bract axil; scapes to 1 cm long, concealed by bracts; ovary with pedicel 14 mm long, much exceeding the subtending floral bract. **Flowers** light lavender to waxy white, lined with purple. **Sepals** dissimilar; dorsal ovate, concave, 9 mm long, 4 mm wide, acute; lateral sepals triangular, formed around the long column foot, 1.5 cm long from the tip of the foot to the apex, 5 mm wide, acute. **Petals** obliquely ovate, 8–9 mm long, 4 mm wide. **Lip** ligulate, canalliculate on the lower $\frac{3}{4}$, constricted on the apical $\frac{1}{4}$, with a ligulate callus thickened apically and appearing parabolic in front, reaching beyond the middle. **Column** arcuate, 1.4 cm long including the 8-mm-long foot, broadened and deepened above to accommodate the large pollinarium with stipe 2.5–3 mm long appearing hooklike when viewed laterally. **Capsule** ellipsoid, about 1 cm long.

Epiphytic on the larger branches of trees in wet forests, mostly at low elevations but to 1500 m. Flowering throughout the year. Locally common in Central America, but in Mexico known only from Chiapas; probably widespread in South America.

The fleshy, dark green leaves and waxy, purple-nerved flowers with a very long column foot and long stipe are good features for recognition. Flowers of Central American forms are darker and have a longer callus than do most forms from South America, and possibly there are two or more species here accepted as one. Some plants from northern South America have creamy white flowers. The type of *M. uncatata* shows the shorter callus of South American forms.

Maxillaria vaginalis Rchb. f., Beitr. Orchid.-K.C.Amer. 77. 1866. TYPE: Costa Rica, De-

sengaño, Wendland 1247 (holotype: w). *Cammaridium wercklei* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:58–59. 1923. TYPE: Costa Rica, San Cristobal, *Wercklé 5* (Drawing of type: AMES). Figure 13F.

Plant a somewhat straggly, erect to decumbent, cane-forming epiphyte or terrestrial to about 1 m long; stems anchored at the base, concealed by bracts, formed from successively borne shoots each terminated by a pseudobulb and diminishing in size from the base. Roots to 1 mm in diameter. **Pseudobulbs** ovoid, compressed, 1–3.5 cm long, concealed by imbricate bracts and sheaths of the subtending 1–3 leaves; apex 1-foliate. **Leaves** at base of pseudobulb with conspicuous sheaths constricted at the articulation, apical leaf conspicuously petiolate; blades similar, keeled below, narrowly elliptic, 7–30 cm long, 1.5–6 cm wide, acute. **Inflorescence** 1 per non-foliaceous rhizome bract axil of developing shoots, not within the axils of developing leaves; scapes to about 4 cm long; ovary with pedicel 1–1.2 cm long, exceeded by the subtending acute floral bract to about 2.5 cm long. **Flowers** delicate in texture, white to pink, lip white, column anther yellowish. **Sepals** similar, oblong, acute, 3–4 cm long, about 1 cm wide; dorsal somewhat concave; lateral sepals oblique and recurved at about the middle. **Petals** falcate-oblancoate, 3.5 cm long, to 1 cm wide, acute. **Lip** firmly attached to the column foot, canalliculate from the base, to about 2.4 cm long, 7 mm wide in natural position, apical $\frac{1}{3}$ distinctly 3-lobate; lateral lobes somewhat spreading, rounded; midlobe ovate, obtuse; callus of 5 fleshy ridges within at the base and with a single fleshy, ligulate callus thickened apically and extending from below the middle to beyond the sinuses between lateral lobes. **Column** slender, arcuate, 1.4–1.7 cm long excluding the foot and anther; foot about 5 mm long. **Capsule** broadly ellipsoid, about 2 cm long with persistent column.

Epiphytic and terrestrial in wet montane forests at 1500–2600 m. Available data on collections suggest this may prefer habitats with high precipitation but little wind. Flowering July to October and February. Costa Rica to Panama.

Maxillaria vaginalis is one of the larger-flowered species of the *M. sigmoidea* complex. It is easily recognized by the rather large white to pink flowers on plants with pseudobulbs on the canes and a straight, not sigmoid, lip.

Maxillaria valenzuelana (A. Rich.) Nash, Bull. Torrey Bot. Club 34:121. 1907. *Pleurothallis valenzuelana* A. Rich., Sagra, Hist. Fis. Cuba 11:234. 1850. TYPE: Cuba, Valenzuela, *Wright 3314* (holotype: P?). *Marsupiaria valenzuelana* (A. Rich.) Garay, Arq. Jard. Bot. Rio de Janeiro 12:183. 1952. *Dicrypta iridifolia* Bateman ex Rchb. f., Bonplandia 2:16. 1854. TYPE: Cuba, *Poeppig* (holotype: w). *Maxillaria iridifolia*

(Bateman ex Rchb. f.) Rchb. f., *Bonplandia* 2: 16. 1854. *Dicrypta irisphyta* Barb. Rodr., Gen. et Sp. Orch. Nov. 1:126. 1877. TYPE: Brazil, Minas Gerais (Martius, C. F. P. von, et al. 1896. *Flora brasiliensis* 3(6): t. 17, fig. 2). *Marsupiarina iridifolia* Hoehne, Arq. Bot. Est. São Paulo n.s. 2, pt. 4:71. 1947. Figure 18A.

Plant a pendent, psymoid, glaucous, essentially monopodial epiphyte with very abbreviated nonswollen stems but lacking pseudobulbs. Roots grayish, to 2 mm in diameter. Mature **leaves** 5–10, equitant, remaining unexpanded, linear to lanceolate in profile, somewhat falcate, acute, 8–60 cm long, 1.4–2.7 cm wide measured from margin to midvein, articulation oblique. **Inflorescence** a fascicle of successively borne, single-flowered scapes; each scape to about 2 cm long, hidden by the subtending rhizome bract and covered by acute scape bracts; ovary with pedicel 2–2.5 cm long, subtended by a rudimentary, short, obtuse floral bract. **Flowers** presented downward with the pendent shoot, greenish yellow, the lip deeper yellow with spots of red or purple. **Sepals** narrowly elliptic to broadly lanceolate, 12–18 mm long, 3–5 mm wide, acute. **Petals** elliptic, 10–16 mm long, about 3 mm wide, acuminate. **Lip** fleshy, rhombic to obovate and slightly 3-lobate above the middle, 10–15 mm long, 5–7 mm wide; midlobe broadly acute, fleshy, 4–5 mm long. **Column** about 5 mm long, forming a short foot at the base. **Capsule** ellipsoid, 2.5 cm long.

A pendent epiphyte of trunks and larger branches in premontane wet forests at 1000–1500 m. Flowering throughout the year. Eastern Cuba (type), Nicaragua, Costa Rica and adjacent western Panama, Colombia, Venezuela, and Brazil.

Maxillaria valenzuelana varies in plant and flower size over the range. Specimens seen from eastern Cuba have leaves that are broad at the base and somewhat abruptly tapering as in Costa Rican material. All material from Nicaragua has noticeably narrower leaves. Floral size of specimens from Costa Rica and Panama is about 50% larger than in those from Nicaragua and Honduras, a feature consistent with the larger leaves.

Maxillaria valerioi Ames & C. Schweinf., Sched. Orch. 10:96–97. 1930. TYPE: Costa Rica, Province of Cartago, vicinity of Pejivalle, Standley & Valerio 46940 (holotype: AMES; isotype: US). Figure 2D.

Plant a shrubby epiphyte on large branches; rhizomes forming mostly upright canes sometimes with a few branches, entirely concealed by sheaths. Roots fibrous, white, mostly forming at the base of the plant and infrequently on the canes, rarely to 1 mm in di-

ameter. **Pseudobulbs** absent. **Leaves** densely distichous, the sheath orangish in dried material, with hyaline margins; blade coriaceous, short leaves elliptic, long leaves lanceolate, 1–10 cm long, 5–10 mm wide, the base clasping, the apex unequally 2-lobate. **Inflorescence** 1 per leaf axil, mostly concealed by subulate bracts; scapes 1–3 cm long; ovary and pedicel 3–5 mm long, exceeded by the subtending floral bract. **Flowers** campanulate, white aging yellowish. **Sepals** 8.5–11 mm long, 2–2.5 mm wide; dorsal elliptic-lanceolate, acute; lateral falcate-lanceolate and acute to rounded. **Petals** elliptic, 7.5–9 mm long, 2–3 mm wide, obtuse. **Lip** pandurate in outline, with lateral lobes on the basal $\frac{1}{2}$, obtuse to acute in front; midlobe rhombic to broadly oblanceolate; callus fleshy, ligulate on the lower $\frac{1}{2}$. **Column** and foot 5–6 mm long excluding the anther; foot 1–1.5 mm long.

Epiphytic and locally common, sometimes terrestrial in premontane rain forests at 550–1300 m. Flowering January to July. Costa Rica and western Panama.

Vegetatively, *M. valerioi* is extremely variable in leaf size, shape, and density. It resembles members of the *M. dendrobioides* complex, but the white flowers and long, narrow, pandurate lip distinguish it.

Maxillaria variabilis Bateman ex Lindl., Edwards's Bot. Reg. 23: sub. t. 1986. 1837. TYPE: Mexico. *Maxillaria curtipes* Hook. f., Ic. Pl. 4: t. 384. 1841. TYPE: Guatemala *J. Parkinson* (holotype: K). *?Maxillaria chiriquensis* Schltr. Repert. Spec. Nov. Regni Veg. Beih. 17:68. 1922. TYPE: Panama, Chiriquí, ca. 4000 ft, Powell 125 (isotypes: AMES, US; drawing of type: AMES). Figure 11C.

Plant a somewhat straggly epiphyte to about 25 cm high. Stems elongate; pseudobulbs approximate to about 4 cm apart. Roots to about 1 mm in diameter. **Pseudobulbs** fusiform to cylindric, often glaucous, subtended by nonfoliaceous sheaths, apically 1-foliate, 1.5–4 cm long, to 1.25 cm wide. **Leaves** thin, usually shortly petiolate, the blade narrowly elliptic to lanceolate, 5–14 cm long, 6–20 mm wide, the apex obtuse to unequally 2-lobate. **Inflorescence** formed in the flush of new growth, to about 2 cm long; ovary with pedicel 1.3–2 cm long. **Flowers** orange to yellow with red stain, rarely dark red (Mexico), the lip yellow with dark, shiny red center. **Sepals** similar, lanceolate to elliptic, 1–1.5 cm long, about 5 mm wide, acute to obtuse; dorsal concave and more elliptic, the lateral more lanceolate to falcate. **Petals** oblanceolate, 1–1.4 cm long, 4–5 mm wide; apex acute and strongly recurved. **Lip** simple to lightly 3-lobate, more or less straight with the sides somewhat embracing the column, elliptic-ovate, 1–1.3 cm long, 5–6.5 mm wide; apex truncate to rounded or retuse; callus a fleshy and shiny ligule on the lower $\frac{1}{2}$. **Column** arcuate, 6–9 mm long excluding the anther; foot 1.5–2 mm long.

Plants of semideciduous forests at 600–1800 m. Flowering November to April and August. Mexico to Panama; possibly to Peru.

Maxillaria variabilis is most closely related to *M. caespitifica* Rchb. f. and *M. costaricensis*. *Maxillaria caespitifica* is a smaller plant with smaller, greener flowers, while *M. costaricensis* has green to cream red-stained flowers and occurs in wetter habitats. Populations north of the Central Valley have closer pseudobulbs than do those from southern Costa Rica. *Maxillaria chiriquensis*, here interpreted cautiously as a synonym, has yellow flowers, but the plant appears more slender, as in *M. costaricensis*. Other populations in southern Costa Rica have much stouter shoots with broader leaves than plants to the north. Various authors, including this one, have misinterpreted *M. curtipes* as an earlier synonym of *M. houtteana* Rchb. f., a species that doubtfully occurs in Costa Rica.

Maxillaria vittariifolia L. O. Williams, Ceiba 4: 38. 1953. TYPE: Costa Rica, Puntarenas, El General Valley C. H. Lankester 1581 (holotype: US; isotypes: AMES, SEL). *Maxillaria linearis* L. O. Williams, name. Not *M. linearis* C. Schweinf. Figure 25B.

Plant densely caespitose, very small, to 7 cm tall. Roots white, to 0.5 mm in diameter. **Pseudobulbs** orbicular to ovoid, 6–10 mm tall, 5–8 mm wide, subtended by 1–2 leaf-bearing rhizome bracts, apex 1-foliate. **Leaves** linear, 20–55 mm long, 1.5–2 mm wide, tapering toward the base. **Inflorescence** 1 per rhizome bract axil, slender, erect, equaling or exceeding the leaves, to 6 cm long, with 2–3 remote and inconspicuous bracts plus 1 subtending the flower; ovary with pedicel shorter than the subtending bract, about 2 mm long. **Flowers** white, the lip with bright orange apex. **Sepals** elliptic-ovate, 5 mm long, 1.6–2 mm wide, obtuse. **Petals** elliptic-oblong, 4.5 mm long, 1.5 mm wide, obtuse. **Lip** broadly obovate when spread, 3.5 mm long, 4 mm wide; apex divided into 3 equal lobes; midlobe reflexed and side lobes embracing the column, the central part with a pair of calli. **Column** stout, to 2.5 mm long; anther minutely papillose. **Capsule** globose.

Poorly known ecologically; epiphytic in premontane and lower montane primary forests at 900 m. Flowering probably throughout the year. Costa Rica, but to be expected in adjacent Panama.

This species is one of the smallest-flowered species of *Maxillaria* in Costa Rica with odd filiform peduncles and might better be classified in its own genus.

Maxillaria wercklei (Schltr.) L. O. Williams, Ann. Missouri Bot. Gard. 27:284. 1940. *Ornithidium wercklei* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:60. 1923. TYPE: Costa Rica, San Pedro de San Ramón, Wercklé 61 (not found), Brenes 112 (neotype selected here: AMES 28776). Figure 13A.

Plant a somewhat straggly epiphyte to 15 cm tall; rhizome erect or decumbent, rooted mostly at the base. Roots to 0.5 mm in diameter. **Pseudobulbs** about 4 cm apart, cylindric to somewhat tapered, 1–1.5 cm long, about 5 mm wide at the base; subtended when young by 1–2 foliate sheaths; apex 1-foliate. **Leaves** coriaceous to fleshy, sessile, elliptic, 7–25 mm long, 5–10 mm wide, with unequally 2-lobate apex. **Inflorescence** 1 per rhizome bract axil of the developing shoot; scape less than 1 cm long; ovary with pedicel 3.5–4.5 mm long, exceeded by the subtending floral bract. **Flowers** translucent tan with red veins or entirely red. **Sepals** similar, elliptic-lanceolate, 6.5–9 mm long, 2–3 mm wide, acute; laterals inserted on the column foot. **Petals** elliptic-lanceolate, about 6–8 mm long, 2–3 mm wide, acute. **Lip** hinged to the column foot, ovate in general outline, 4.5–5 mm long, about 3 mm wide when spread, 3-lobate at the base; lateral lobes short, not exceeding $\frac{1}{4}$ the lip; midlobe suborbicular, obtuse, the side margins much recurved; callus tongue-like exceeding and connecting the lateral lobes. **Column** stout, 1.5–2 mm long excluding the anther; foot about 1 mm long; anther about 1 mm in diameter.

Maxillaria wercklei is a premontane rain forest species at (300)500–1350 m. Flowering November to January and August. Apparently endemic to Costa Rica, but to be expected in adjacent Panama. Plants identified as *M. wercklei* from Panama appear to be *M. lankesteri* Ames.

The understanding of *M. wercklei* is based on the Brenes collection cited by Schlechter (Repert. Spec. Nov. Regni Veg. Beih. 19:244. 1923). Neither the holotype nor any isotypes of *M. wercklei* based on Wercklé 61 have been found. *Maxillaria lankesteri* is usually considered as a later synonym, but that species is easily distinguished by the much larger flowers.

Excluded Taxa

Maxillaria cobanensis Schltr., Repert. Spec. Nov. Regni Veg. 10:295. 1912. This was reported by L. O. Williams (1956) as occurring in Costa Rica, but specimens have been seen only from Mexico, possibly to Nicaragua. Despite the lack of specimens, R. L. Dressler believes he may have seen it in Costa Rica. Plants from Honduras appear similar to a small, caespitose, rather

broad-leaved variety of *M. variabilis* with brown-purple flowers.

Maxillaria houtteana Rehb. f., Hamb. Gartenz. 14:212. 1858. This species occurs from Mexico possibly to Nicaragua. It was treated (by J. T. A.) as a synonym of *M. curtipes* Hook. f. (Icon. Pl. Trop. 14: t. 1342) based on a collection from Mexico in the belief that it probably occurs in Costa Rica based on the checklist of L. O. Williams (1956), but no specimens south of Nicaragua have been seen. Subsequent examination of the type of *M. curtipes*, rather than photographs, revealed that *M. curtipes* is a synonym of *M. variabilis* Batem. ex Lindl., as suggested by M. Soto A. (pers. comm.).

Mormolyca Fenzl

(J. T. Atwood)

REFERENCES—L. A. Garay & M. Wirth, On the genera *Mormolyca* Fenzl and *Cyrtoglottis* Schltr. Canad. J. Bot. 37:479–490. 1959. L. van der Pijl & C. H. Dodson, Orchid Flowers. University of Miami Press, Coral Gables, Florida. 214 pp. 1966.

Epiphytic caespitose or rhizomatous and creeping herb. **Pseudobulbs** ovoid or elongate, variously compressed. **Leaves** 1–4 at the pseudobulb apex, none at the base, conduplicate, chartaceous to coriaceous, linear to elliptic-oblong. **Scapes** 1-flowered, laterally produced at the base of the pseudobulb, elongate, usually with the internodes exposed between bracts; ovary distinctly pedicellate, at least in the Central American species. **Flowers** ringent, usually with rather lurid colors. **Sepals** similar or dissimilar, never connate. **Petals** similar or dissimilar to the sepals. **Lip** simple or 3-lobate, often with appearance of an insect. **Column** stout or slender; pollinia 4, usually without a stipe (stipe present in at least 1 South American species) but supported on a viscidium. **Fruit** a capsule.

A Neotropical genus of about six species. The primary distinguishing feature of *Mormolyca* is the footless column, although one could argue that a foot is actually present that does not extend beyond the receptacle. The flowers appear adapted for pseudocopulation, although the author is unaware of any observations of natural pollination. Only a single species is known in Central America (see note under *Maxillaria piestopus* Schltr.).

Garay and Wirth (1959) suggested that *Mormolyca* and related *Trigonidium* may prove inseparable from *Maxillaria*, a view also held by one

of us (J. T. A.). The heavily veined leaves, caespitose pseudobulbs lacking foliaceous sheaths at the base, obsolete column foot, usually sharp lateral lobes of the lip, and distinctly pedicellate ovaries strongly suggest a relationship with the *Maxillaria rufescens* complex.

Mormolyca ringens (Lindl.) Schltr., Die Orchideen 436. 1914. *Trigonidium ringens* Lindl., Edwards's Bot. Reg. 26: misc. 57. 1840. TYPE: Mexico, Hartweg (κ, photo seen). *Mormolyca lineolata* Fenzl, Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. Figure 26A.

Plant a caespitose epiphyte to about 40 cm tall. Rhizome short, roots to 2.5 mm in diameter. **Pseudobulbs** ovoid, congested, smooth when turgid, rugose if at all dehydrated, somewhat compressed, 2–4 cm long, 1.5–4 cm wide, subtended by fugaceous, nonfoliaceous bracts, apex 1-foliate. **Leaves** coriaceous and strongly veined above, shortly petiolate, elliptic, acute, 9.5–44 cm long, 1.3–5.5 cm wide. **Inflorescence** 1 or more per shoot, lateral, wiry, with 5–7 appressed bracts including the floral bract, internodes conspicuously exposed; ovary with pedicel 3–4.5 cm long, the pedicel 2.25–3.6 cm long, subtended by a floral bract 7–12 mm long. **Flowers** ringent, not very variable, with petals pointing upward and parallel with the dorsal sepal, lateral sepals pointing downward and parallel to each other, greenish aging tan, veined with red; lip with maroon callus at base. **Sepals** dissimilar; dorsal concave, elliptic acute to shortly acuminate, 1.4–1.6 cm long, 7–8 mm wide; lateral convex, elliptic-falcate, 1.5–1.7 cm long, 5.5–7 mm wide, with apex bluntly acute and somewhat recurved. **Petals** similar to the lateral sepals but smaller, somewhat convex, elliptic-falcate, somewhat twisted, 1.3–1.5 cm long, 4–5 mm wide, apex obtuse and acuminate. **Lip** porrect and parallel with the column, somewhat velvety, 3-lobate below the middle, elliptic-rhombic in general outline, 7–8 mm long when spread, 4–6 mm across the lateral lobes; lateral lobes short, triangular, and acute; midlobe recurved apically; calli 2, the first at the base triangular, velvety, a second callus at the middle, somewhat elevated and horseshoe-shaped in front. **Column** arcuate, clavate, essentially lacking a foot, 8 mm long without anther, anther ca. 1 mm long; pollinia 4, with horseshoe-shaped viscidium.

Epiphytic on larger branches of evergreen to semideciduous forests; usually common locally in the northern parts of its range. Flowering probably throughout the year. Widespread from Mexico to at least northern Costa Rica.

Mormolyca ringens is easily recognized throughout its range by the unifoliate, clustered pseudobulbs and wiry scapes supporting rather gaping, greenish to tan flowers marked with red and maroon. Even sterile specimens should be easily distinguished if old scapes are present.

Trigonidium Lindl.

(J. T. Atwood)

Epiphytic or lithophytic, caespitose or rhizomatous and creeping **herb**. **Pseudobulbs** ovoid or elongate, variously compressed laterally. **Leaves** 1–5 at pseudobulb apex, none at the base, conduplicate, chartaceous to coriaceous, linear to elliptic-oblong. **Scapes** elongate, bracteate, 1-flowered, produced at the base of the mature pseudobulb or immature shoot. **Flowers** campanulate, appearing triangular from the front, usually more or less brown with petal apices metallic blue to white. **Sepals** similar when spread. **Petals** much smaller than sepals. **Lip** 3-lobate, shorter than lateral petals, and with a simple callus. **Column** nearly straight, wingless, forming at most a very short foot at the base; pollinia 4, waxy. **Fruit** a capsule.

Key to the Species of *Trigonidium*

- 1a. Plants conspicuously rhizomatous, pseudobulbs bearing >2 leaves at the apex. *T. lankesteri*
- 1b. Plants caespitose, pseudobulbs apically 2-foliolate 2
- 2a. Flowering mostly November to June; flowers arising from the axils of bracts of mature shoots; ovary with pedicel 4.7–7 cm long; narrowest leaves at least 14 mm wide .. *T. egertonianum*
- 2b. Flowering mostly August to October; flowers arising from the axils of bracts of immature shoots; ovary with pedicel 4–4.5 cm long; widest leaves 13 mm wide or less
..... *T. riopalenquense*

***Trigonidium egertonianum* Bateman ex Lindl.**, Edwards's Bot. Reg. 24: misc. p. 73. 1838. TYPE: Honduras, *G. U. Skinner* (holotype: K, photo seen). *Trigonidium seemannii* Rchb. f., Seem. Bot. Voy. Herald. 214. 1854. TYPE: Panama, *Seemann s.n.* (holotype: w). Figure 26B.

Plant a caespitose epiphyte often forming massive clumps. Roots velamentous, to 2.5 mm in diameter. **Pseudobulbs** approximate, ovoid in outline, somewhat laterally flattened, apically 2-foliolate, 4.5–7 cm long and 1.7–3 cm wide, with several longitudinal grooves becoming more apparent on drying, invested basally by several nonfoliaceous bracts. **Leaves** 2 at the pseudobulb apex, narrowly oblanceolate, arcuate near the apex in live material, acute, 30–48 cm long and 1.2–2.5 cm wide. **Inflorescence** 1-flowered, arising laterally at the base of the most recently completed shoot on peduncles 25–45 cm long, covered by 8–10 closely appressed tubular sheaths; ovaries with pedicels 4.7–7 cm long. **Flowers** green to orange, faintly reticulated with purple thus appearing brown, the petals provided with a metallic blue spot near the apex. **Sepals** closely appressed at the base but broadly expanded apically, quadrate to obovate, acuminate, 3–4 cm long and 1–2 cm wide. **Petals** lanceolate, acute, shortly clawed, 1.5–2 cm long and 4–6 mm wide. **Lip** 8–10 mm long with 3 lobes diverging above the middle; lateral lobes turned upward around the column and provided centrally with a ligulate callus; apical lobe orbicular, verrucose, and reflexed. **Column** terete, 4–6 mm long.

A perplexing Neotropical genus of perhaps 12 species differing mainly in floral size and growth habit. Three species are known in Central America, all in Costa Rica.

The relationships of *Trigonidium* with the rest of the Maxillariinae are unclear, but there are vegetative and floral similarities with some of the Brazilian species of *Maxillaria* (*M. picta* group). *Trigonidium* itself is probably monophyletic, held together by the similar and rather odd floral apomorphies such as the campanulate presentation of the perianth and shiny spot on the petal apex.

Epiphytic on larger branches of trees of evergreen or less often semideciduous forests at 0–1000 m; rarely lithophytic; usually common. Flowering in November to June. Widespread from Mexico into South America.

Trigonidium egertonianum resembles closely *T. riopalenquense* Dodson, with which it occasionally occurs on the same host. They are best distinguished by the length of the ovary with the pedicel and by the habit of flowering either on completed growth (*T. egertonianum*) or on immature growth (*T. riopalenquense*). Leaf width is helpful in determining sterile specimens, but a depauperate plant of *T. egertonianum* could easily be misdetermined as *T. riopalenquense* on this feature alone.

Trigonidium seemannii Rchb. f. is here interpreted as a synonym of *T. egertonianum*. The holotype of *T. seemannii* (w) consists only of a drawing of a scape and flower, but only *T. egertonianum* is known from the type locality, lowland central Panama. Furthermore, Reichenbach intended the name *T. seemannii* to replace *T. egertonianum*, a species with a description he believed to be defective. Described from Honduran material, *T. egertonianum* is the only species of *Trigonidium* known north of Nicaragua.

Trigonidium lankesteri Ames, Sched. Orch. 5: 32–34. June 1923. TYPE: Costa Rica, *Lankester* 367 (holotype: AMES). *Trigonidium amparoanum* Schltr., Repert Spec. Nov. Regni Veg. Beih. 19:61. Nov. 1923. TYPE: Costa Rica, Carillo, C. Wercklé 26 (not found). *Trigonidium insigne* of authors. Not Rchb. f. ex Benth. & Hook. Figure 26D.

Plant conspicuously rhizomatous, the ascending shoots more than 15 cm apart; roots to about 1.5 mm in diameter. **Pseudobulbs** conical to cylindrical, to about 8 cm long, sheathed basally with obtuse sheaths about 2 cm long, apically 3–5 foliate. **Leaves** imbricate basally, thin, coriaceous, elliptic-oblong to elliptic-lanceolate, 18–28 cm long and 2.5–4(5) cm wide, shortly petiolate. **Inflorescence** a solitary flower borne on a scape concealed by imbricating bracts and rising from the base of the most recently formed shoot. **Flowers** large for the genus, brown. **Sepals** 4.5–6 cm long and 1.5–2 cm wide, connivent basally, sharply reflexed above the middle, acute apically. **Petals** elliptic-oblancoate, about 2.5 cm long, thickened apically. **Lip** 1.4 cm long and about 5 mm wide, 3-lobate apically, the lateral lobes erect, the midlobe minutely glandular; callus bilobed. **Column** about 1 cm long.

An uncommon and striking epiphyte of tropical and premontane rain forests from Costa Rica to South America to about 1000 m. Flowering August and September.

The large flowers, ascending rhizomatous habit, and apically 3–5-foliate pseudobulbs readily distinguish this species from others. *Trigonidium lankesteri* also occurs at higher elevations. The name *T. insigne* Rchb. f. ex Benth. & Hook. f. has been misapplied to South American plants that appear to be *T. lankesteri*. The holotype of *T. insigne* based on a Colombian specimen collected by Purdie (κ) is a large plant related to and probably conspecific with *T. egertonianum* Batem. ex Lindl.

Trigonidium riopalenquense Dodson, Selbyana 2:56. 1977. TYPE: Ecuador, Los Ríos, *Dodson* 5251 (holotype: SEL). Figure 26C.

Plant a caespitose epiphyte, sometimes shortly creeping, rarely forming large clumps. Roots velamentous, to 2 mm in diameter. **Pseudobulbs** approximate, even when exhibiting a creeping habit, ovoid, compressed, rarely conical, with furrows formed rather irregularly on drying, 2–3.5 cm long and 1.7–2.3 cm wide, 2-foliate, sheathed basally by 2 or more bracts disintegrating with age. **Leaves** linear to very narrowly oblanceolate, acute, 30–40 cm long and 0.6–1.2 cm wide. **Inflorescences** lateral, 1-flowered, arising from the axil of a bract protecting the immature shoot, supported on a peduncle 17–25 cm long covered by 7–9 closely appressed bracts;

ovary with pedicel 4–4.5 cm long. **Flowers** greenish to pinkish yellow to brown. **Sepals** rhombic, obovate, acuminate, 2.8–3.4 cm long and 1–1.5 cm wide. **Petals** with a metallic blue “eye” apically, lanceolate, acute, 1.5 cm long and 5–6 mm wide. **Lip** 6–8 mm long, with 3 lobes diverging above the middle, the lateral lobes turned upward around the column, the apical lobe orbicular, verrucose, and reflexed, with a ligulate callus on the lower half. **Column** terete, 4–5 mm long. Capsule ellipsoid, about 3 cm long.

Uncommon epiphytes of lowland humid tropics from Nicaragua to Ecuador but easily confused with *T. egertonianum* (see notes under that species). Flowering in Costa Rica from August to October.

Subtribe Oncidiinae Benth.

REFERENCES—M. W. Chase, A reappraisal of the Oncidioid orchids. Syst. Bot. 11:477–491. 1986. M. W. Chase & J. D. Palmer, Floral morphology and chromosome number in subtribe Oncidiinae (Orchidaceae): Evolutionary insights from a phylogenetic analysis of chloroplast DNA restriction site variation. In P. S. Soltis, et al., Molecular Systematics of Plants. Chapman and Hall, New York, New York, pp. 324–337. 1992. R. L. Dressler, The Orchids. Harvard University Press, Cambridge, Massachusetts, and London, England, 332 pp. 1981. R. L. Dressler, Phylogeny and Classification of the Orchid Family. Dioscorides Press, Portland, Oregon, 314 pp. 1993. L. O. Williams, An enumeration of the Orchidaceae of Central America, British Honduras and Panama. Ceiba 5: 1–256. 1956.

Plant usually an epiphytic herb, rarely terrestrial or more commonly opportunistically terrestrial. Rhizomes short or variously elongate; roots with white velamen, variously thickened. **Pseudobulbs** usually present, of a single internode, sheathed at the base with articulate foliaceous bracts or by nonfoliaceous and nonarticulate bracts; apex of 1–several leaves. **Leaves** thin to fleshy, conduplicate and flat, less often equitant or terete, articulate or less often nonarticulate, linear to elliptic, petiolate to nonpetiolate. **Inflorescence** a raceme, panicle with various patterns of branching, or less often a scape with solitary flower; ovary usually with long pedicel. **Flowers** usually complex in form and color pattern, color various but perianth segments often marked with maroon, red, or brown. **Sepals** similar or dissimilar, often concave, often unguiculate, the laterals often variously connate. **Petals** usually large and showy, sometimes larger than the sepals, sometimes unguiculate. **Lip** simple to complexly lobed, with complex calli consisting of various plates and tubercles. **Column** usually complex,

often with a plate ventrally near the base (tabula infrastigmatica), often complexly winged above; anther with 2 pollinia with stipe of varying length and a viscidium.
Fruit a capsule.

An exclusively Neotropical subtribe of about 77 genera and more than 1,200 species. Thirty-five genera are known in Costa Rica with a total of 112 species.

The Oncidiinae is best developed in South America and grows in wet to nearly desert habitats from sea level to more than 3500 m. Although rather well defined as a subtribe, the genera within it are particularly problematic, especially the genus *Oncidium*, which is defined on the basis of plesiomorphic character states, including the obtuse angle formed by the column and lip.

Key to Subtribe Oncidiinae

- 1a. Leaves laterally flattened (equitant) 2
 - 2a. Stems elongate; plant never fanlike 3
 - 3a. Plants creeping monopodials 4
 - 4a. Flowers white to green, segments < 5 mm *Pachyphyllum*
 - 4b. Flowers red to purple, segments > 5 mm long *Fernandezia* (tica)
 - 3b. Plants never creeping *Lockhartia*
 - 2b. Stems not elongate, plant fanlike 5
 - 5a. Sepals and petals narrowly lanceolate to attenuate, “spidery” *Macroclinium*
 - 5b. Sepals and petals elliptic to ovate, never “spidery” 6
 - 6a. Inflorescence a panicle of subumbels; floral segments < 3.5 mm long *Trizeuxis* (*falcata*)
 - 6b. Inflorescence never subumbellate; floral segments > 3.5 mm long .. *Psymmorchis*
- 1b. Leaves not laterally flattened, either dorso-ventrally flattened or terete 7
 - 7a. Plant monopodial, usually creeping 8
 - 8a. Flowers red to purple, segments > 5 mm long *Fernandezia* (tica)
 - 8b. Flowers white to green, segments < 5 mm *Pachyphyllum*
 - 7b. Plant sympodial 9
 - 9a. Spur, chin, or column foot present 10
 - 10a. Only 1 leaf per shoot 11
 - 11a. Basal side margins of lip as well as petals embracing the column *Plectrophora* (*alata*)
 - 11b. Neither lip base nor petals embracing the column *Trichocentrum*
 - 10b. Leaves 2 or more per shoot 12
 - 12a. Appendage present at base of lip; may be enclosed in sepaline spur ... 13
 - 13a. Appendage of lip single, undivided *Rodriguezia* (*compacta*)
 - 13b. Appendages of lip either 2 or 1 and furcate at apex. 14
 - 14a. Flower red; appendages of lip 2, about as long as blade of lip .. *Comparettia* (*falcata*)
 - 14b. Flower yellow; appendage of lip divided near apex, much shorter than blade *Scelochilus* (*aureus*)
 - 12b. Appendage absent at base of lip 15
 - 15a. Column foot conspicuous, broad; flowers green; blade of lip much shorter than sepals *Systeloglossum*
 - 15b. Column foot inconspicuous; flowers either white or lavender, never green; lip much longer than sepals *Ionopsis*
 - 9b. Spur, chin, or column foot absent 16
 - 16a. Lip partially adnate to, or the basal margins embracing the column, sometimes in-rolled and forming a tubular base 17
 - 17a. Lip clearly 3-lobate with sharp sinuses between the lobes, the midlobe much narrower than the lateral lobes 18
 - 18a. Flowers white; lip and petals denticulate ... *Warmingia* (*margaritacea*)

- 18b. Flowers colored, lip and petals entire . . . *Macradenia* [unknown but expected in Costa Rica; reported from Nicaragua and Panama]
- 17b. Lip simple or 3-lobate but with blunt sinuses, or if sharp, then the midlobe much broader than the lateral lobes 19
- 19a. Shoots with 1 apical leaf 20
- 20a. Sepals less than 2 cm long; leaf fleshy . . *Leucohyle (subulata)* [unknown but expected in Costa Rica; reported from Nicaragua and Panama]
- 20b. Sepals > 2 cm long; leaf thin *Trichopilia*
- 19b. Shoots with leaves at base of pseudobulb in addition to the 1–2 apical leaves 21
- 21a. Side lobes of lip not clasping nor in-rolled around the column; pseudobulb apex with 2(1) leaves *Aspasia*
- 21b. Side lobes of lip either clasping or in-rolled around the column; pseudobulb apex with 1 leaf *Cischweinfia*
- 16b. Lip entirely free from, although sometimes parallel with, the column when viewed laterally 22
- 22a. Leaf 1 restricted to pseudobulb apex 23
- 23a. Sepals > 4 cm long 24
- 24a. Dorsal sepal linear; lateral sepals much broader, falcate; petals similar to the dorsal sepal, antenna-like *Psychopsis (krameriana)*
- 24b. Sepals all similar *Rossiglossum (schlieperianum)*
- 23b. Sepals < 4 cm long 25
- 25a. < 4 flowers per inflorescence *Ticoglossum*
- 25b. > 4 flowers per inflorescence *Oncidium*
- 22b. Leaves > 1 per shoot 26
- 26a. Petals broad, at least 1.3 cm broad, never yellow or olivaceous . . 27
- 27a. Flowers mostly chestnut brown *Otoglossum (chiriquense)*
- 27b. Flowers white to pink *Miltoniopsis (warszewiczii)*
- 26b. Petals narrower, < 1.25 cm broad, of various colors 28
- 28a. Lateral sepals \geq 7.5 cm long, lanceolate *Brassia*
- 28b. Lateral sepals much shorter than 7.5 cm long 29
- 29a. Lip \geq 2.3 cm long 30
- 30a. Lip more or less acute *Rhynchostele*
- 30b. Lip obtuse, rounded, or emarginate *Oncidium*
- 29b. Lip \leq 2.2 cm long 31
- 31a. Plant with combination of pseudobulb hidden by several subtending leaves, starlike flowers with narrow sepals, the lateral sepals \geq 1.9 cm long, lip less than $\frac{2}{3}$ the lateral sepals *Ada (chlorops)*
- 31b. Combination of features otherwise 32
- 32a. Flowers nonresupinate, white or tinged with lavender; the lip with yellow or red on the callus . . *Osmoglossum*
- 32b. Flowers otherwise 32
- 33a. Angle formed by the column and base of lip \leq 30° when viewed laterally 34
- 34a. Lip simple, biblike or flabellate and emarginate, the blade flat, neither with recurved nor incurved margins 35
- 35a. Lip deeply emarginate or with slightly concave side margins, white to deep lavender *Ionopsis*
- 35b. Lip if emarginate, then with convex side margins, greenish white to yellowish, sometimes spotted *Leochilus*
- 34b. Lip 3-lobate, pandurate, or with recurved or incurved margins 36
- 36a. Lip 3-lobate, with subtriangular lateral lobes near the middle

.....	<i>Goniochilus (leochilinus)</i>	
36b. Lip otherwise		37
37a. Lip shorter than lateral sepals	<i>Mesospinidium</i>	
37b. Lip longer than lateral sepals	<i>Hybochilus (inconspicuus)</i>	
33b. Angle formed by column and lip base > 30° (often much greater than 60°)		38
38a. Column stout, less than twice as long as wide		39
39a. Lip simple, biblike	<i>Leochilus</i>	
39b. Lip 3-lobate	<i>Oncidium</i>	
38b. Column more than twice as long as wide		40
40a. Inflorescence a pendent, densely flowered raceme; lip simple, arrow-shaped	<i>Notylia</i>	
40b. Inflorescence and lip otherwise		41
41a. Column slender, arcuate, at least half as long as and usually more than ¾ the lip length		42
42a. Sepals < 1 cm long	<i>Sigmatostalix</i>	
42b. Sepals > 1 cm long	<i>Amparoa (costaricensis)</i>	
41b. Column not slender and arcuate, usually less than ½ the lip length		43
43a. Sepals > 7 mm long	<i>Oncidium</i>	
43b. Sepals < 6 mm long	<i>Sigmatostalix</i>	

Ada Lindl.

(D. E. Mora de Retana)

REFERENCES—L. A. Garay, Orquídeas colombianas nuevas o críticas. Orquideologia 4:14–21. 1969. N. H. Williams, A reconsideration of *Ada* and the glumaceous brassias (Orchidaceae). Brittonia 24:93–110. 1972.

Epiphytic, caespitose or rhizomatous and creeping herb. **Pseudobulbs** present to obsolete, variously compressed. **Leaves** several per shoot, 1–2 at pseudobulb apex, chartaceous, conduplicate, with usually several conspicuous veins. **Inflorescence** a lateral raceme of several flowers, often 2 or more per shoot. **Flowers** stellate to campanulate with lanceolate to attenuate segments, the lip nearly parallel to the column; pollinia 2, waxy, supported on an obdeltoid stipe and broadly ovate viscidium. **Fruit** a capsule.

A genus of about 14 currently recognized, mostly South American species; two species in southern Central America, but only one in Costa Rica. The genus is easily recognized by the reduced or absent pseudobulbs, the thin leaves with several prominent veins, and the starry to campanulate flowers borne on lateral racemes.

The DNA evidence of Chase and Palmer supports Williams' separation of *Ada* from closely related *Brassia*. Unfortunately, Chase and Palmer did not sample *Mesospinidium*, which is vegetatively similar to *Ada* but usually has smaller and fewer leaves.

Ada chlorops (Endres & Rchb. f.) N. Williams, Brittonia 24:105. 1972. *Brassia chlorops* Endres & Rchb. f., Gard. Chron. 542. 1873. TYPE: Costa Rica, Endres (w). *Brassia parviflora* Ames & C. Schweinf., Sched. Orch. 8:74–75. 1925. TYPE: Costa Rica, Cascajal, Alfaro s.n. (holotype: AMES) Figure 27A.

Plant epiphytic, caespitose, forming small clumps to ca. 40 cm tall. Rhizome short; roots 2–3 mm in diameter. **Pseudobulbs** reduced, ovate-lanceolate, compressed, 3–5 cm long, 1.5 cm wide, covered at the base by the conduplicate sheaths of several leaves, 1-foliate apically. **Leaf** blades articulate, carinate, subcoriaceous, elliptic-lanceolate to obovate, acute, to 34 cm long, 1.3–2.5 cm wide. **Inflorescence** a lateral, 5–10 flowered raceme, 20–35 cm long including the scape, the latter with appressed, acute, membranaceous bracts; ovary with pedicel 1.5–2.5 cm long, subtended by shorter to longer, triangular, apiculate bracts. **Flowers** somewhat fleshy, greenish yellow with brown spots. **Sepals** subequal, free, ovate-lanceolate, acuminate; dorsal erect, 1.5–2.2 cm long, 3–5 mm wide; lateral sepals subfalcate and spreading, 1.9–2.5 cm long, 3–4 mm wide. **Petals** similar to the sepals, 1.2–1.5 cm long, 2–3 mm wide. **Lip** oblong-lanceolate, acute to acuminate, reflexed above the middle, the base adnate to the column, 1.2–1.4 cm long, 5–6 mm wide; callus fleshy, sulcate and pubescent basally, and with a pair of elevated teeth apically. **Column** 5–6 mm long, stout, foot lacking; anther terminal, rounded, papillose, with 2 imperfect cells; pollinia 2, pyriform, with subcordate stipe and viscidium. **Fruit** an ellipsoid capsule ca. 5 cm long.

Epiphytic in premontane and lower montane rain forests mostly at (200)1000–1600(2000) m, where it grows on larger trunks of the host in

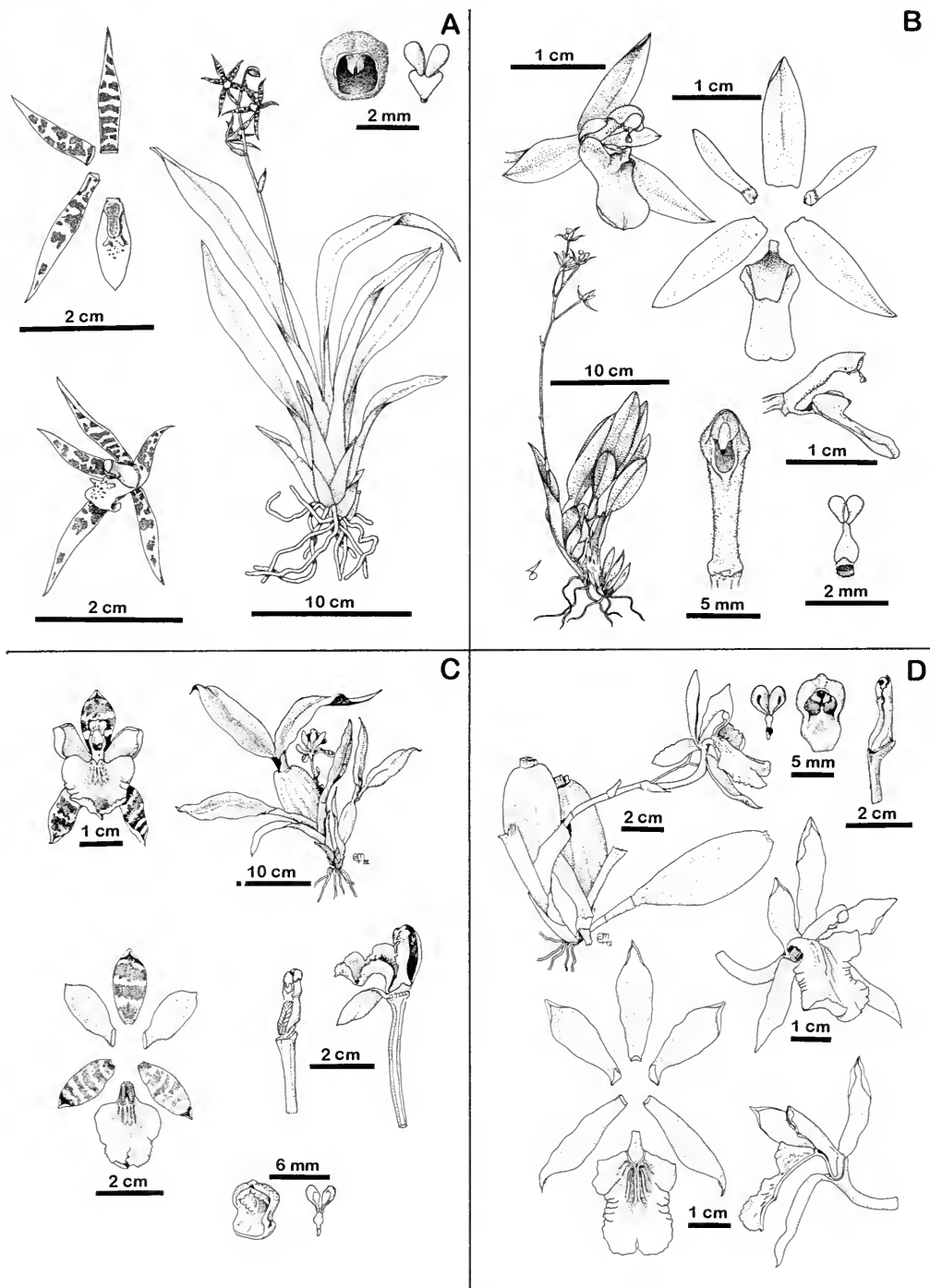


FIG. 27. **A**, *Ada chlorops* (Icon. Pl. Trop. 16: t. 1501. Illustrator: F. Pupulin). **B**, *Amparoa costaricensis* (Icon. Pl. Trop. 7: t. 601. Illustrator: O. Achf). **C**, *Aspasia epidendroides* (Icon. Pl. Trop. 16: t. 1502. Illustrator: C. Marín). **D**, *Aspasia principissa* (Icon. Pl. Trop. 16: t. 1503. Illustrator: C. Marín).

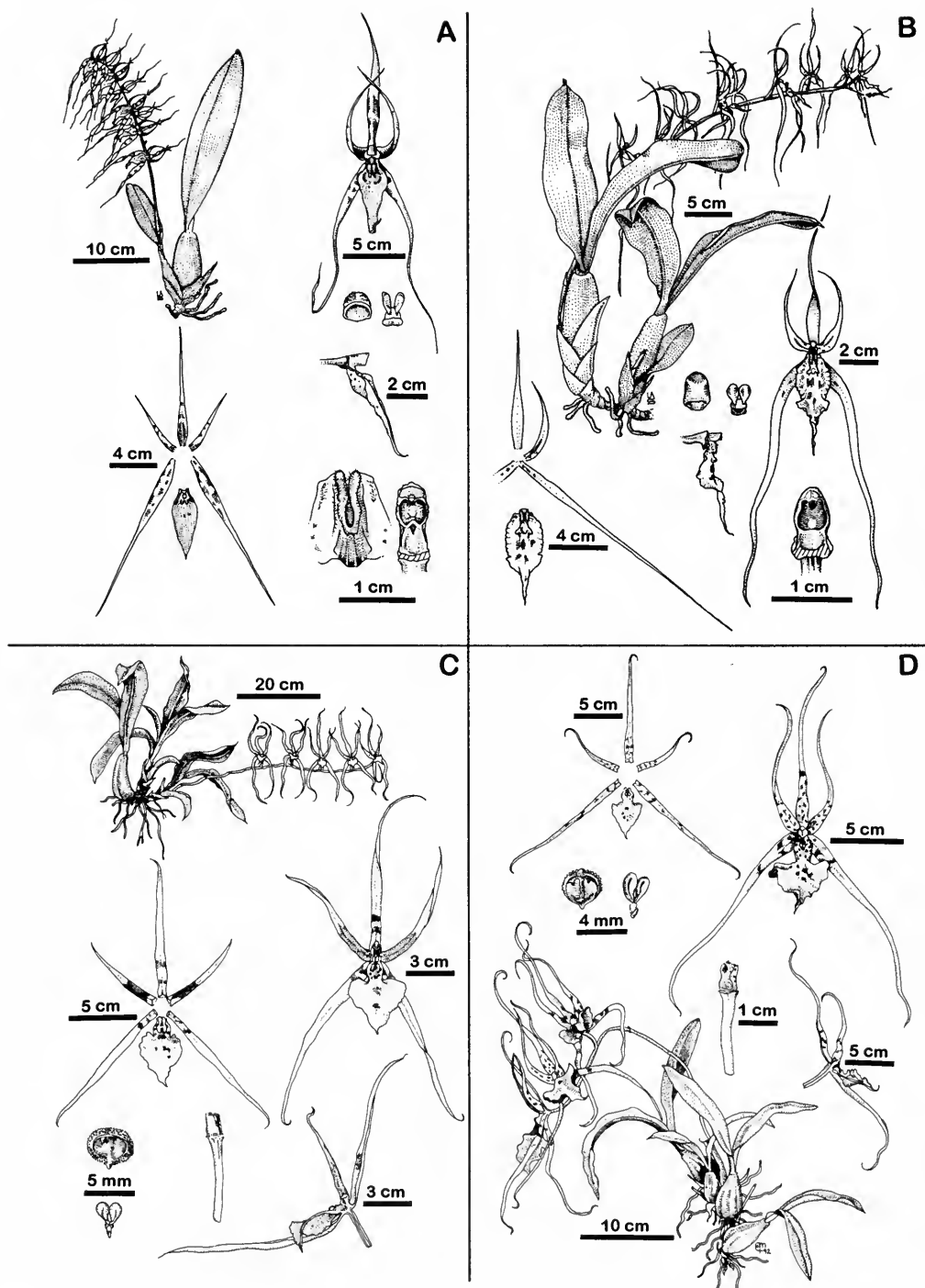


FIG. 28. **A**, *Brassia arcuigera* (Icon. Pl. Trop. 16: t. 1507. Illustrator: L. Alfaro). **B**, *B. caudata* (Icon. Pl. Trop. 16: t. 1508. Illustrator: L. Alfaro). **C**, *B. gireoudiana* (Icon. Pl. Trop. 16: t. 1509. Illustrator: C. Marín). **D**, *B. verrucosa* (Icon. Pl. Trop. 16: t. 1510. Illustrator: C. Marín).

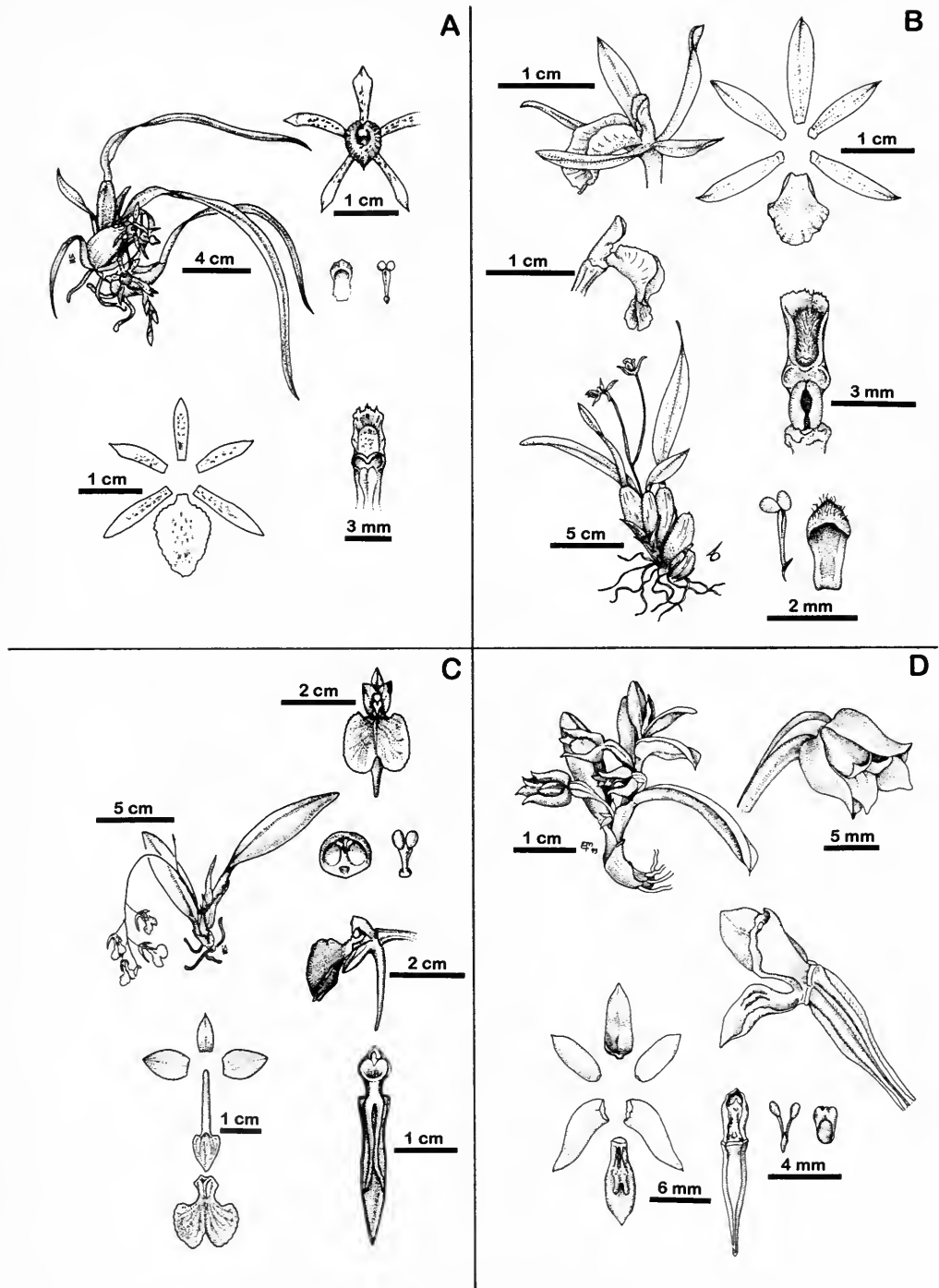


FIG. 29. **A**, *Cischweinfia dasyandra* (Icon. Pl. Trop. 15: t. 1413. Illustrator: L. Alfaro). **B**, *Cischweinfia pusilla* (illustrator: O. Achí). **C**, *Comparettia falcata* (Icon. Pl. Trop. 15: t. 1416. Illustrator: O. Achí). **D**, *Fernandezia tica* (Brenesia 39–40:165. 1993. Illustrator: C. Marín).

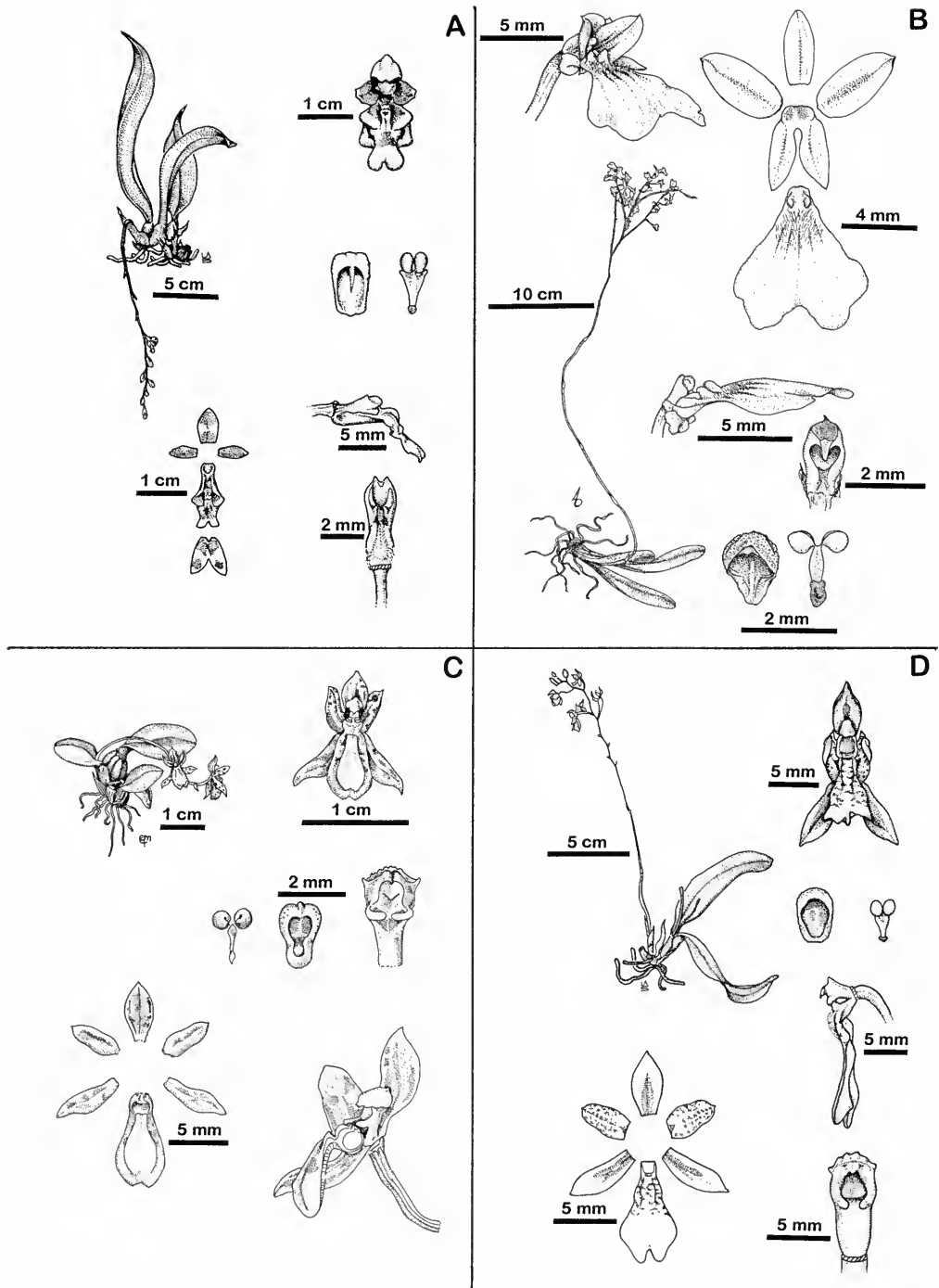


FIG. 30. A, *Goniochilus leochilinus* (Icon. Pl. Trop. 15: t. 1436. Illustrator: L. Alfaro). B, *Ionopsis utricularioides* (illustrator: O. Achí). C, *Leorchilus labiatus* (illustrator: C. Marín). D, *L. tricuspidatus* (Icon. Pl. Trop. 15: t. 1443. Illustrator: L. Alfaro).

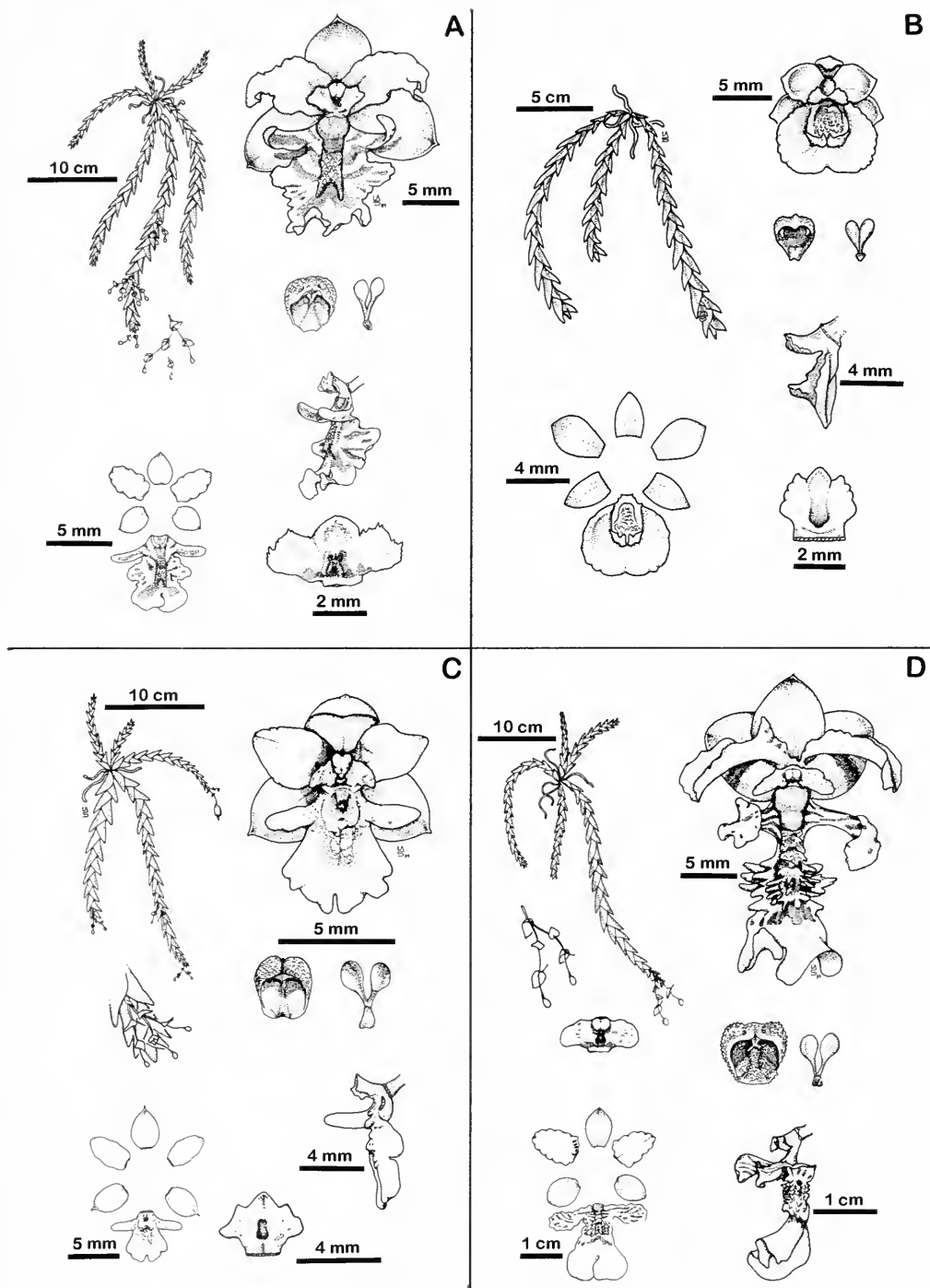


FIG. 31. **A**, *Lockhartia amoena* (Icon. Pl. Trop. 15: t. 1446. Illustrator: L. Alfaro). **B**, *L. hercodonta* (Icon. Pl. Trop. 15: t. 1448. Illustrator: L. Alfaro). **C**, *L. micrantha* (Icon. Pl. Trop. 15: t. 1449. Illustrator: L. Alfaro). **D**, *L. oerstedii* (Icon. Pl. Trop. 15: 1450. Illustrator: L. Alfaro).

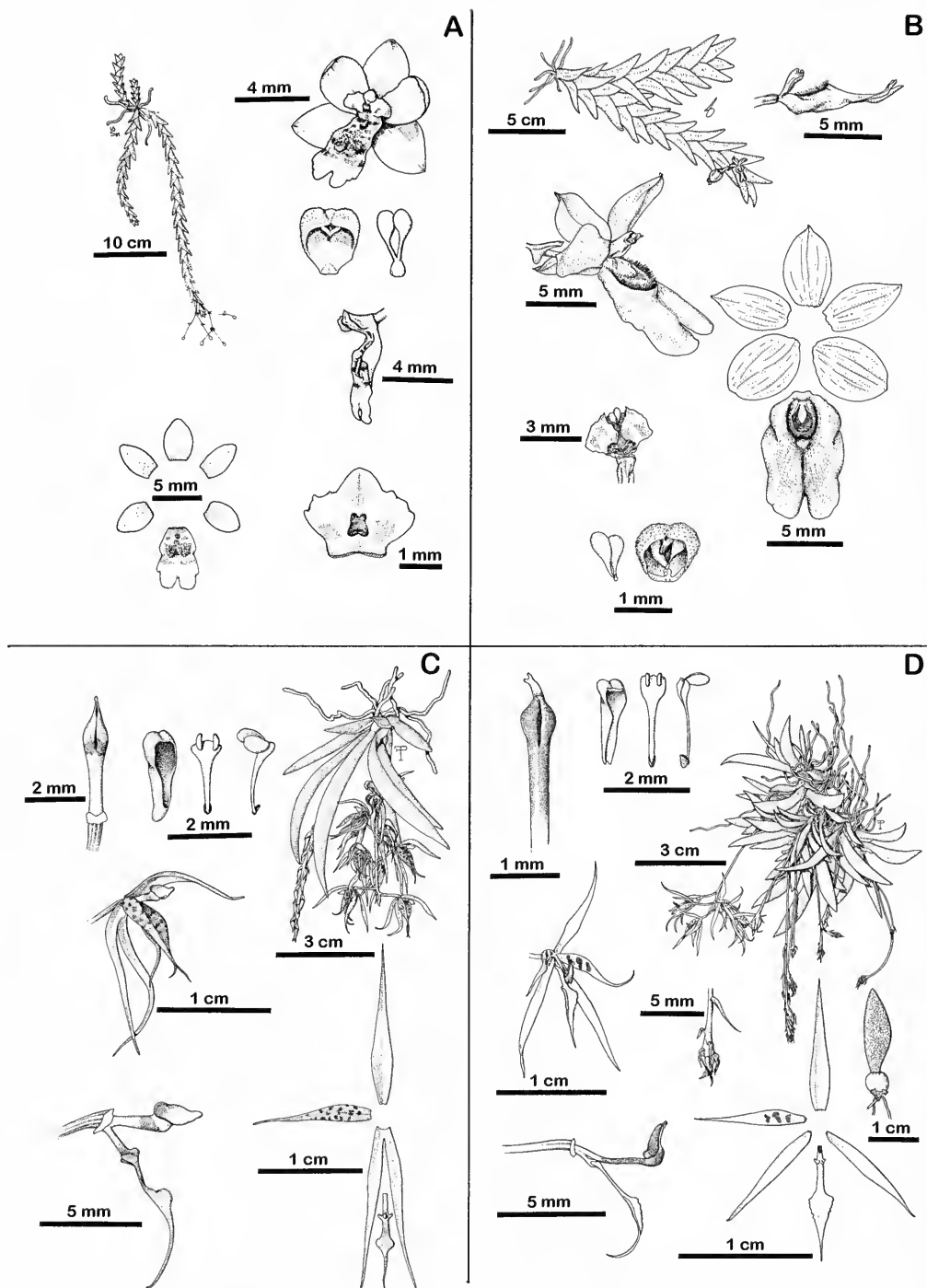


FIG. 32. A, *Lockhartia acuta* (Icon. Pl. Trop. 15: t. 1445. Illustrator: L. Alfaro). B, *L. pitieri* (illustrator: O. Achf). C, *Macroclinium confertum* (Lindleyana 11:139. Illustrator: F. Pupulin). D, *M. generalense* (Lindleyana 11:137. Illustrator: F. Pupulin).

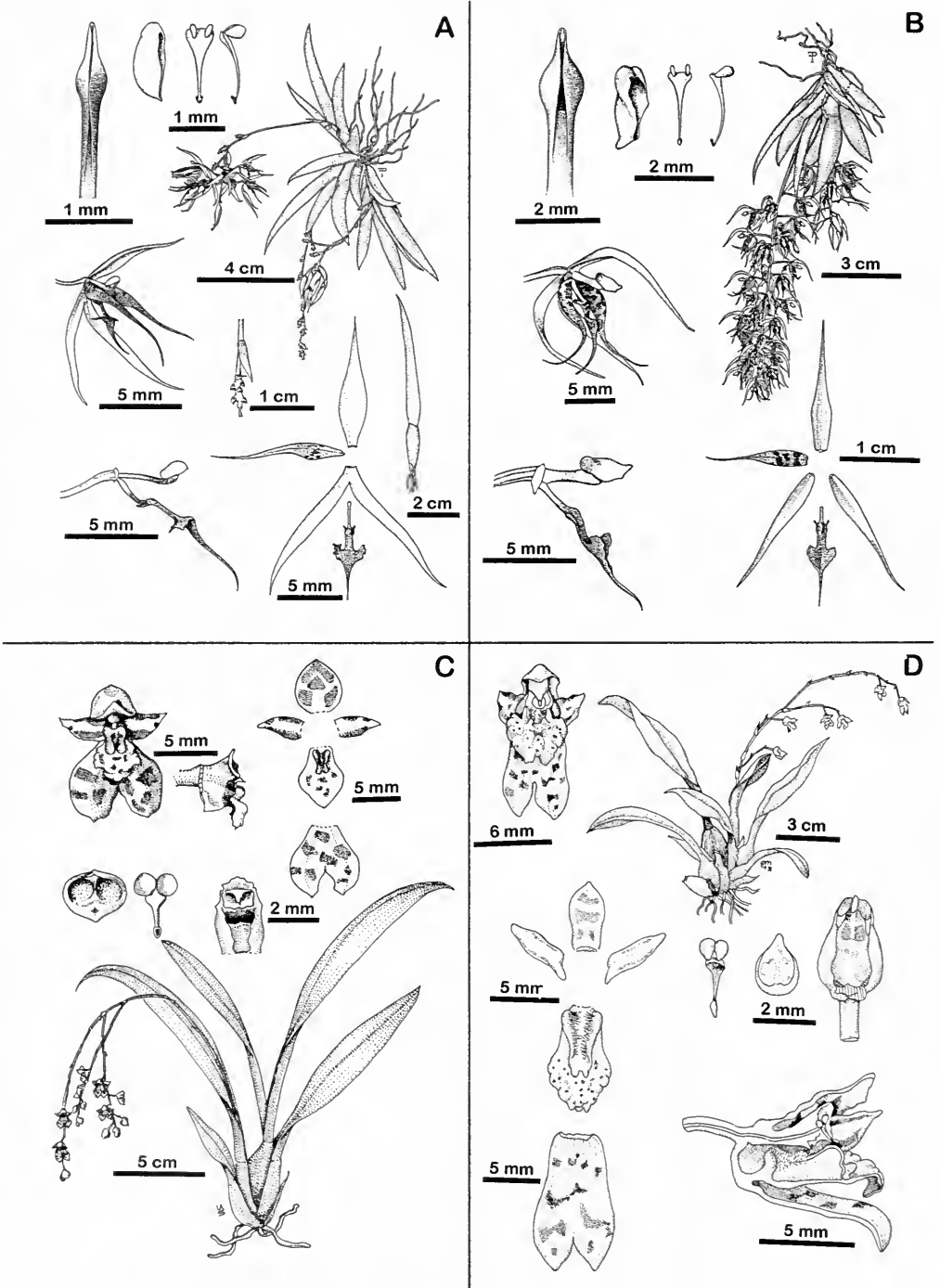


FIG. 33. **A**, *Macroclinium cordesii* (illustrator: F. Pupulin). **B**, *Macroclinium ramonense* (illustrator: F. Pupulin). **C**, *Mesospinidium horichii* (Icon. Pl. Trop. 16: t. 1564, incorrectly as *Mesospinidium endresii*. Illustrator: L. Alfaro). **D**, *Mesospinidium warszewiczii* (Icon. Pl. Trop. 16: 1565. Illustrator: C. Marin).

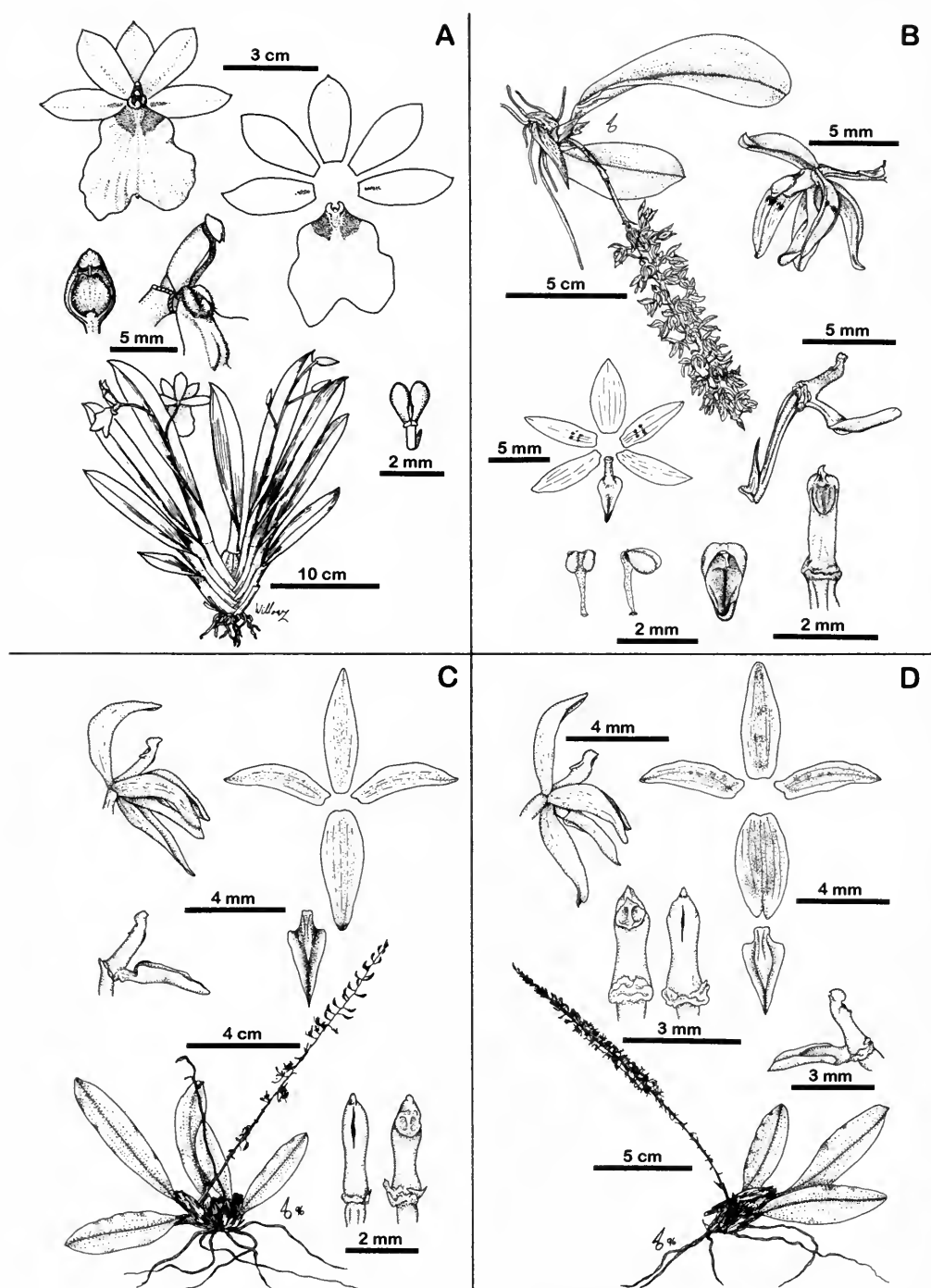


FIG. 34. A, *Miltoniopsis warszewiczii* (illustrator: W. Zuchowski). B, *Notylia trisepala* (illustrator: O. Achí). C, *N. pittieri* (illustrator: O. Achí). D, *N. pittieri* (illustrator: O. Achí).

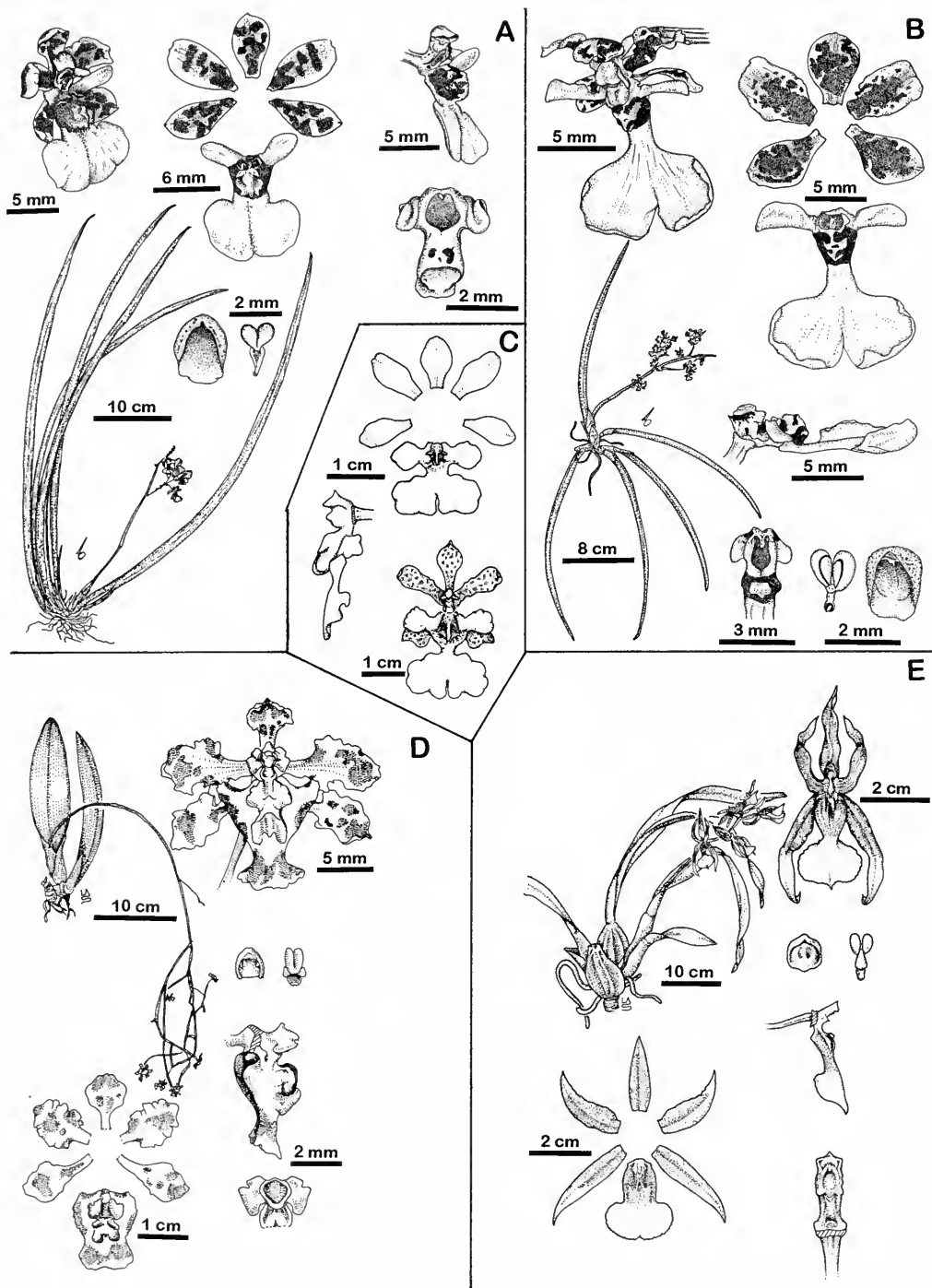


FIG. 35. A, *Oncidium ascendens* (illustrator: O. Achí). B, *O. teres* (illustrator: O. Achí). C, *O. cebolleta* (Icon. Pl. Trop. 15: t. 1467. Illustrator: L. Alfaro). Note: Plant habit is similar to that in Figures 35A, B. D, *O. carthagenense* (Icon. Pl. Trop. 16: t. 1570. Illustrator: L. Alfaro). E, *O. schroederianum* (Icon. Pl. Trop. 15: t. 1472. Illustrator: L. Alfaro).

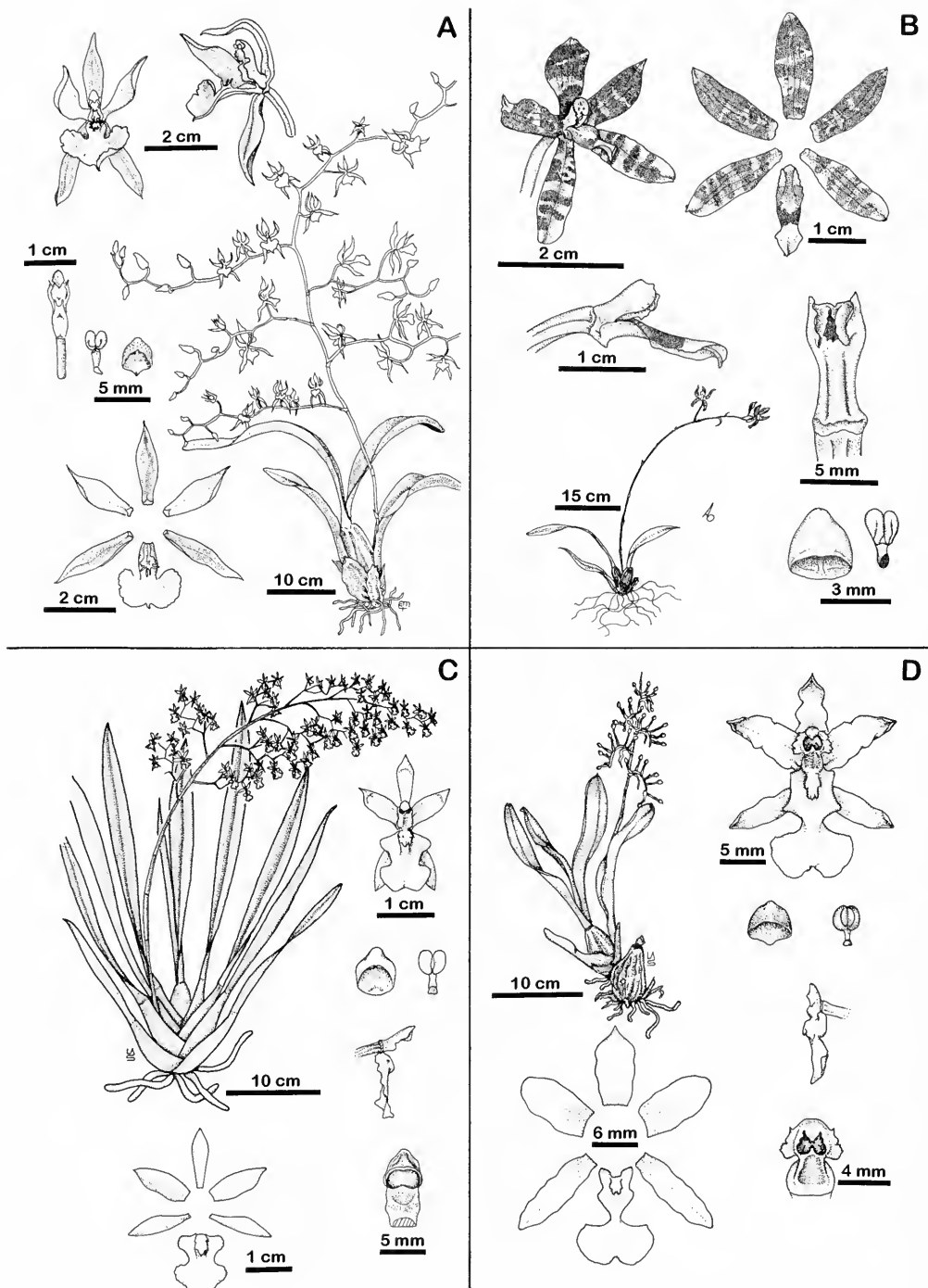


FIG. 36. A, *Oncidium cariniferum* (Icon. Pl. Trop. 16: t. 1569. Illustrator: C. Marín). B, *O. stenoglossum* (illustrator: O. Achí). C, *O. panduriforme* (Icon. Pl. Trop. 15: t. 1471. Illustrator: L. Alfaro). D, *O. storkii* (Icon. Pl. Trop. 15: t. 1474. Illustrator: L. Alfaro).

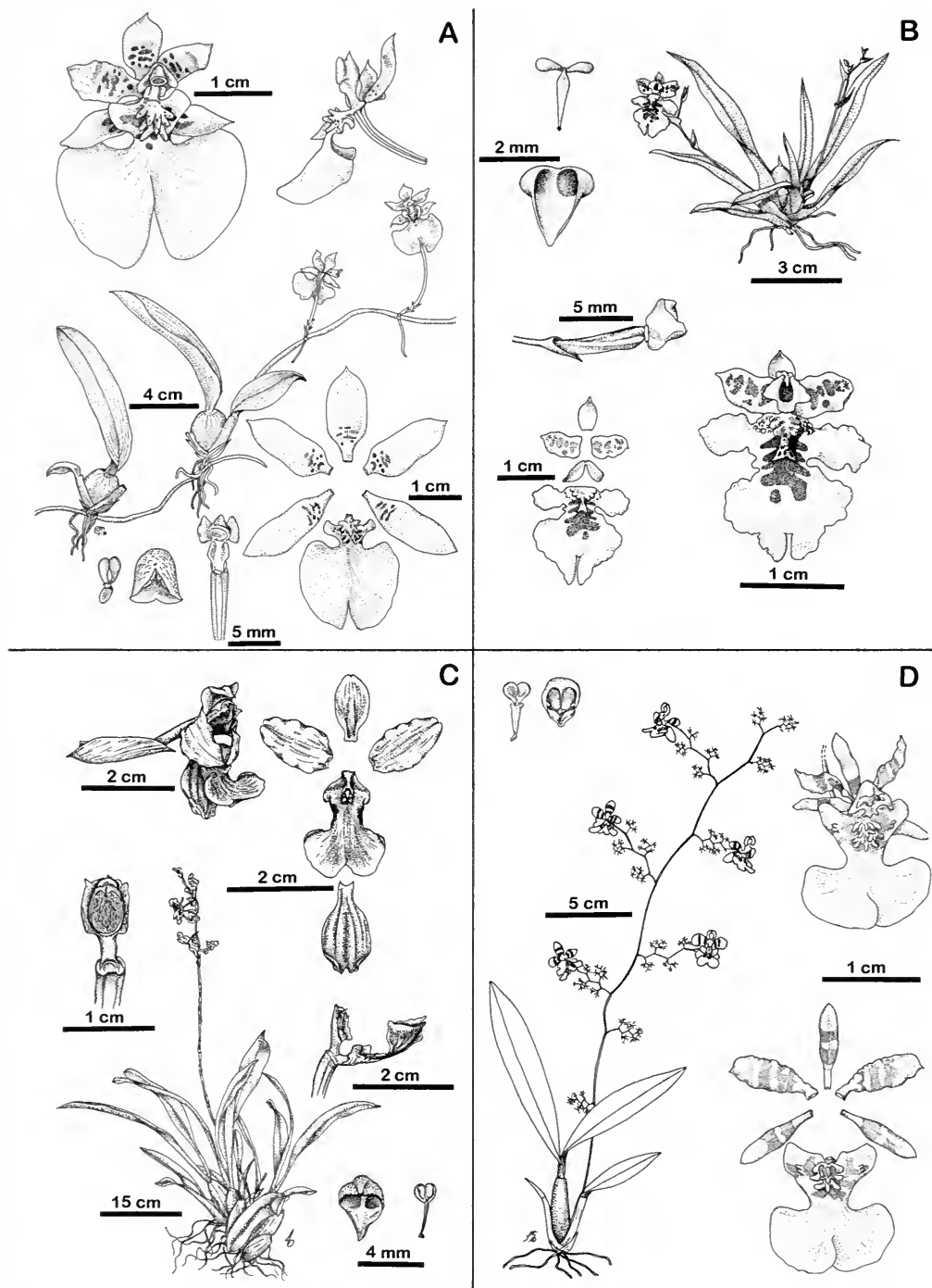


FIG. 37. A, *Oncidium globuliferum* (illustrator: C. Marín). B, *O. cristagalli* (Icon. Pl. Trop. 16: t. 1571. Illustrator: F. Pupulin). C, *O. warszewiczii* (illustrator: O. Achf). D, *O. bryolophotum* (illustrator: S. Dalström).

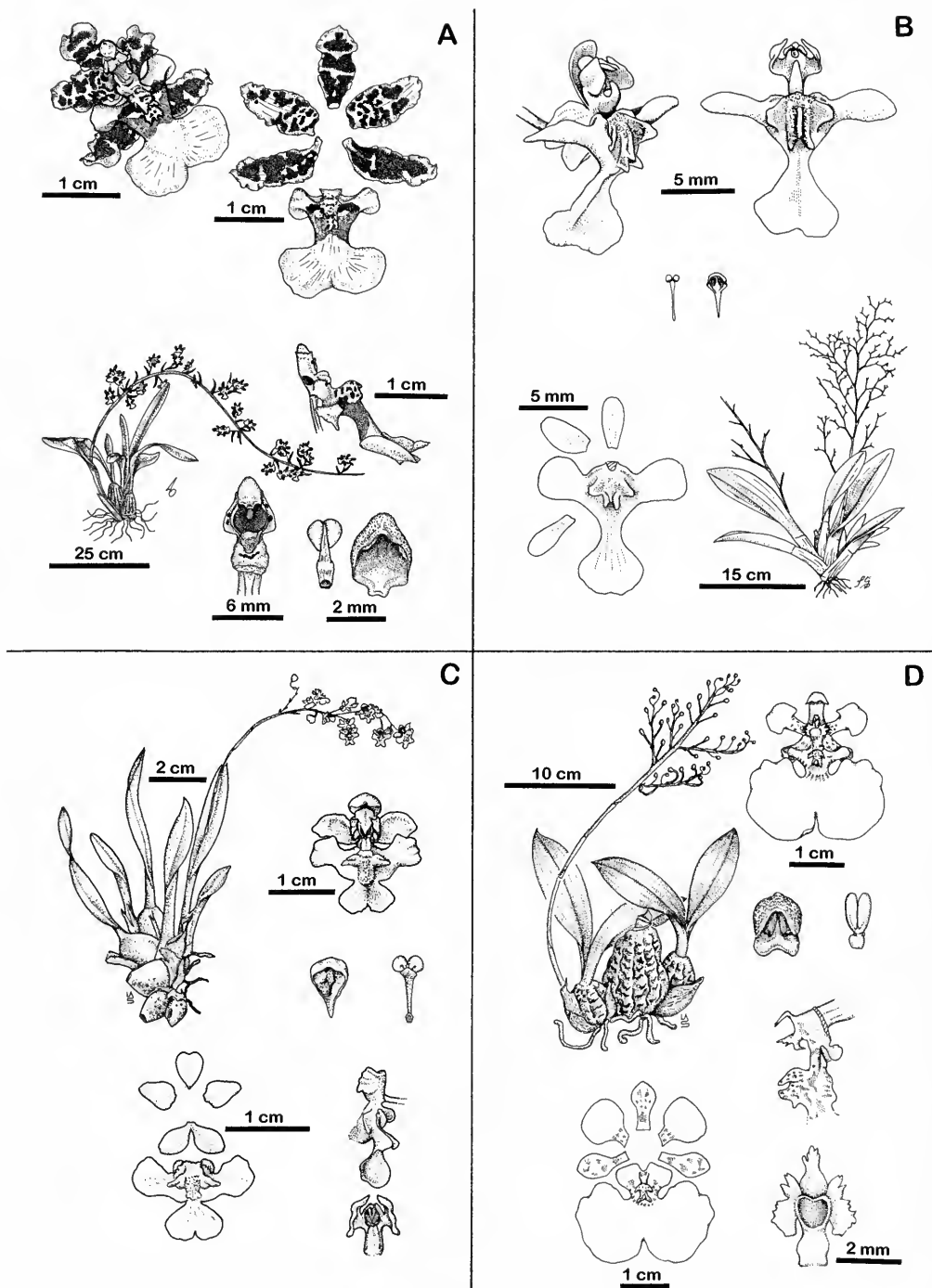


FIG. 38. **A**, *Oncidium bracteatum* (illustrator: O. Achf). **B**, *O. luteum* (Icon. Pl. Trop. 16: t. 1572. Illustrator: S. Dalström). **C**, *O. cheiroporum* (Icon. Pl. Trop. 15: t. 1468. Illustrator: L. Alfaro). **D**, *O. ampliatus* (Icon. Pl. Trop. 15: t. 1464. Illustrator: L. Alfaro).

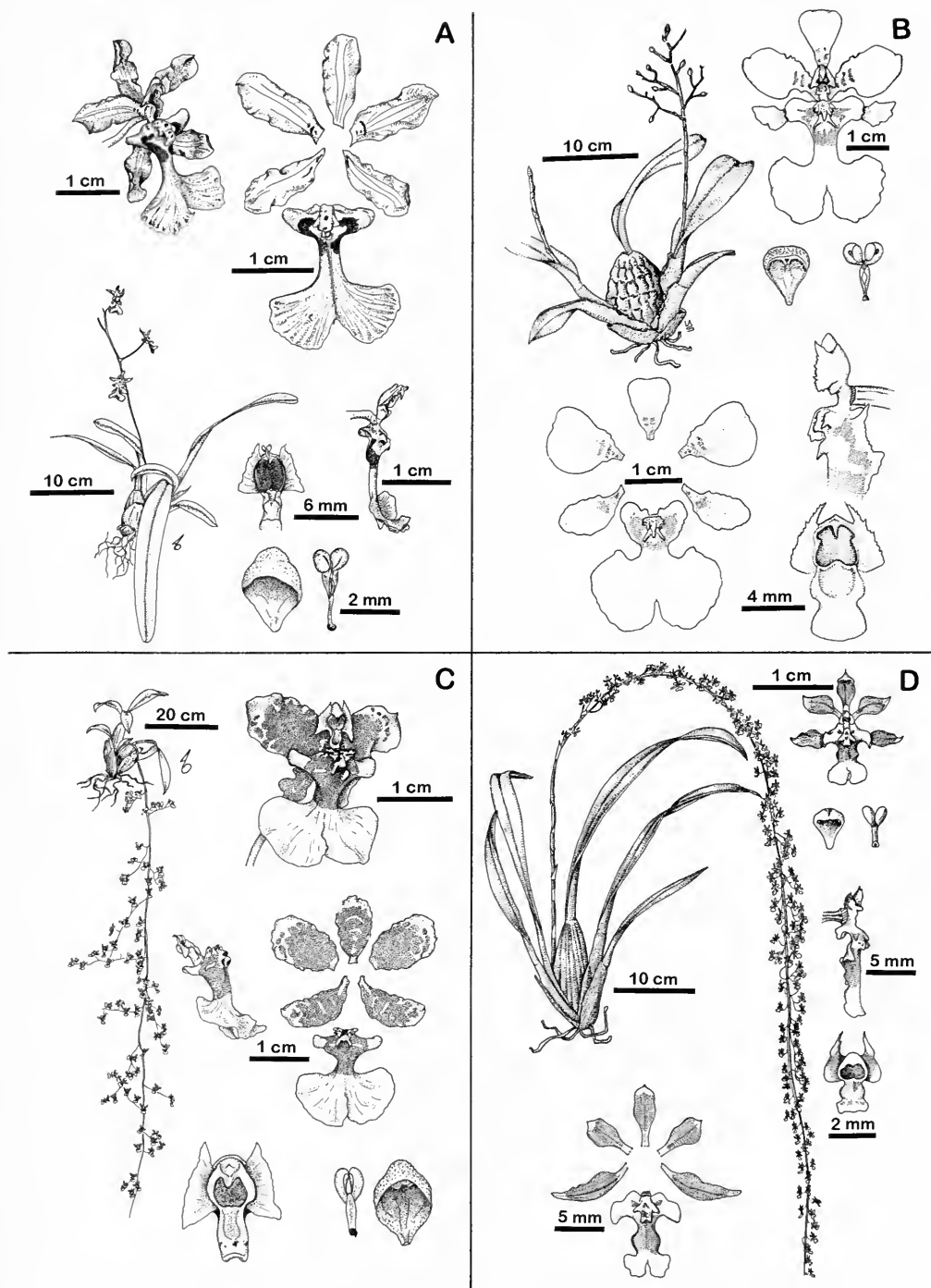


FIG. 39. A, *Oncidium obryzatoides* (illustrator: O. Achí). B, *O. klotzschianum* (Icon. Pl. Trop. 15: t. 1470 as synonym *O. obryzatum*. Illustrator: L. Alfaro). C, *O. dichromaticum* (Illustrator: O. Achí). D, *O. parviflorum* (illustrator: L. Alfaro).

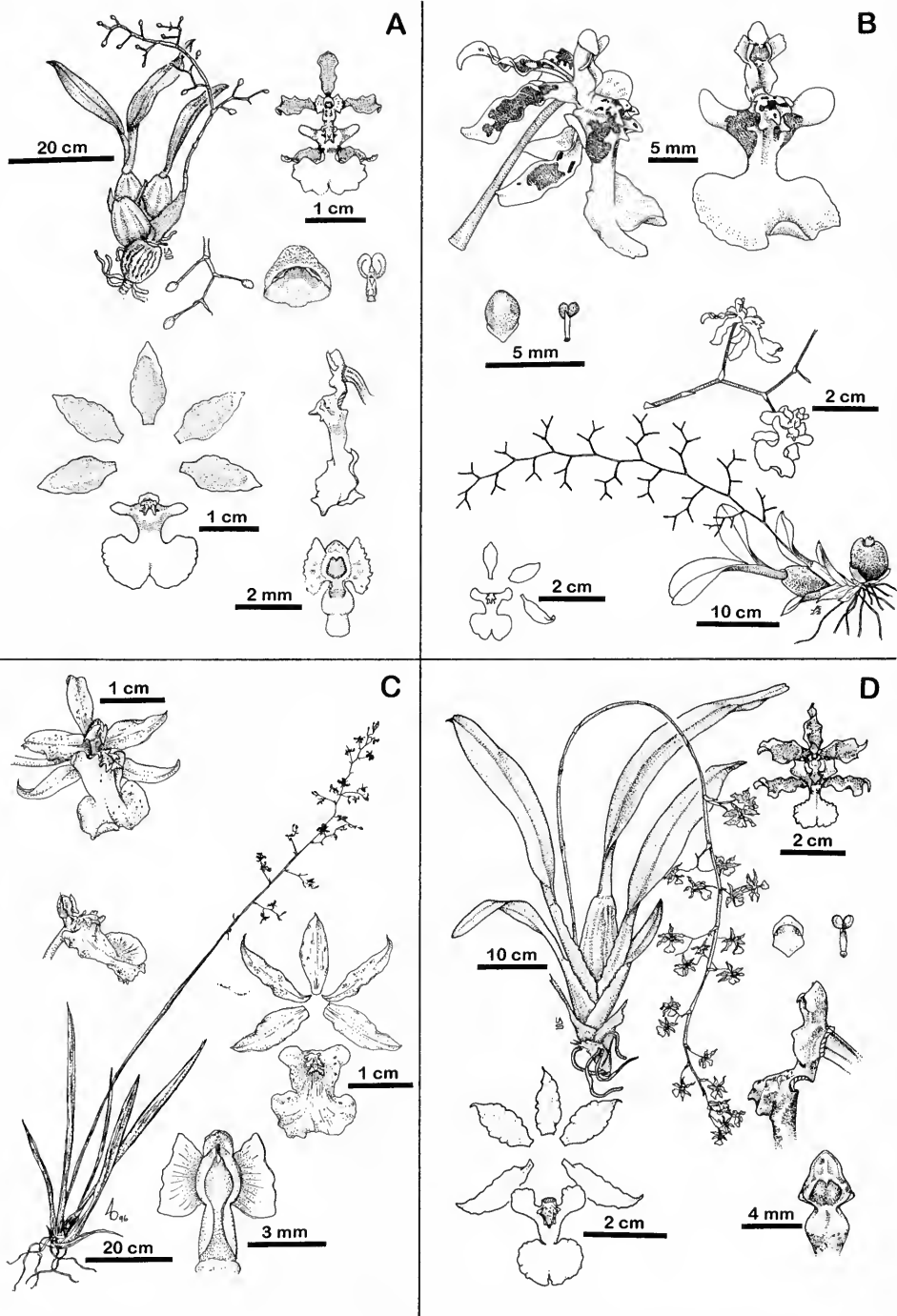


FIG. 40. **A**, *Oncidium ansiferum* (Icon. Pl. Trop. 15: t. 1465. Illustrator: L. Alfaro). **B**, *O. stenobulbon* (illustrator: S. Dalström). **C**, *O. ensatum* (illustrator: O. Achí). **D**, *O. stenotis* (Icon. Pl. Trop. 15: t. 1473. Illustrator: L. Alfaro).

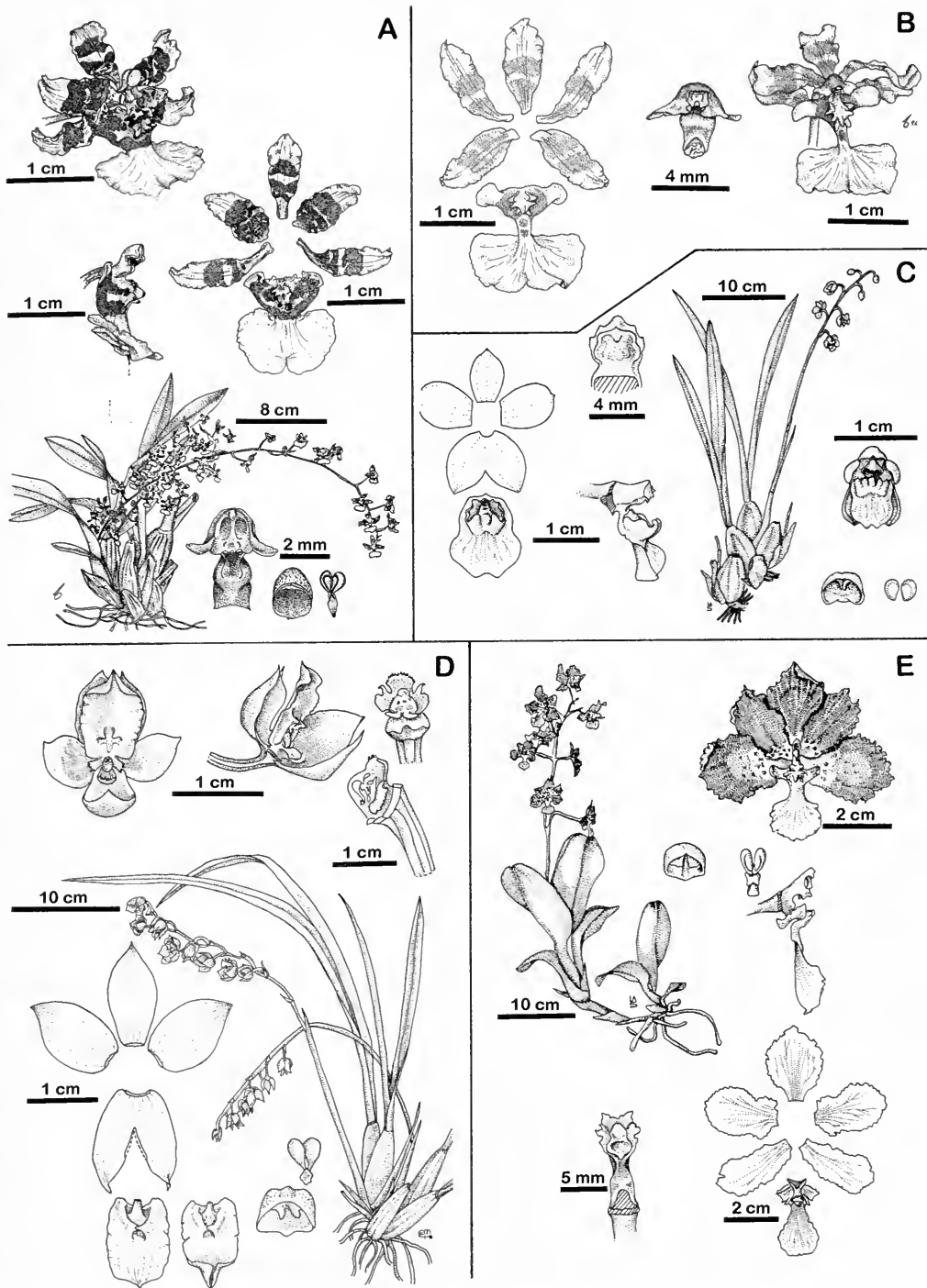


FIG. 41. **A**, *Oncidium polycladium* (illustrator: O. Achí). **B**, *Oncidium isthmi* (illustrator: O. Achí). Note: Plant habit is similar to that in Figure 41A. **C**, *Osmoglossum convallarioides* (Icon. Pl. Trop. 15: t. 1475. Illustrator: L. Alfaro). **D**, *Osmoglossum egertonii* (illustrator: C. Marín). **E**, *Otaglossum chiriquense* (Icon. Pl. Trop. 16: t. 1573. Illustrator: L. Alfaro).

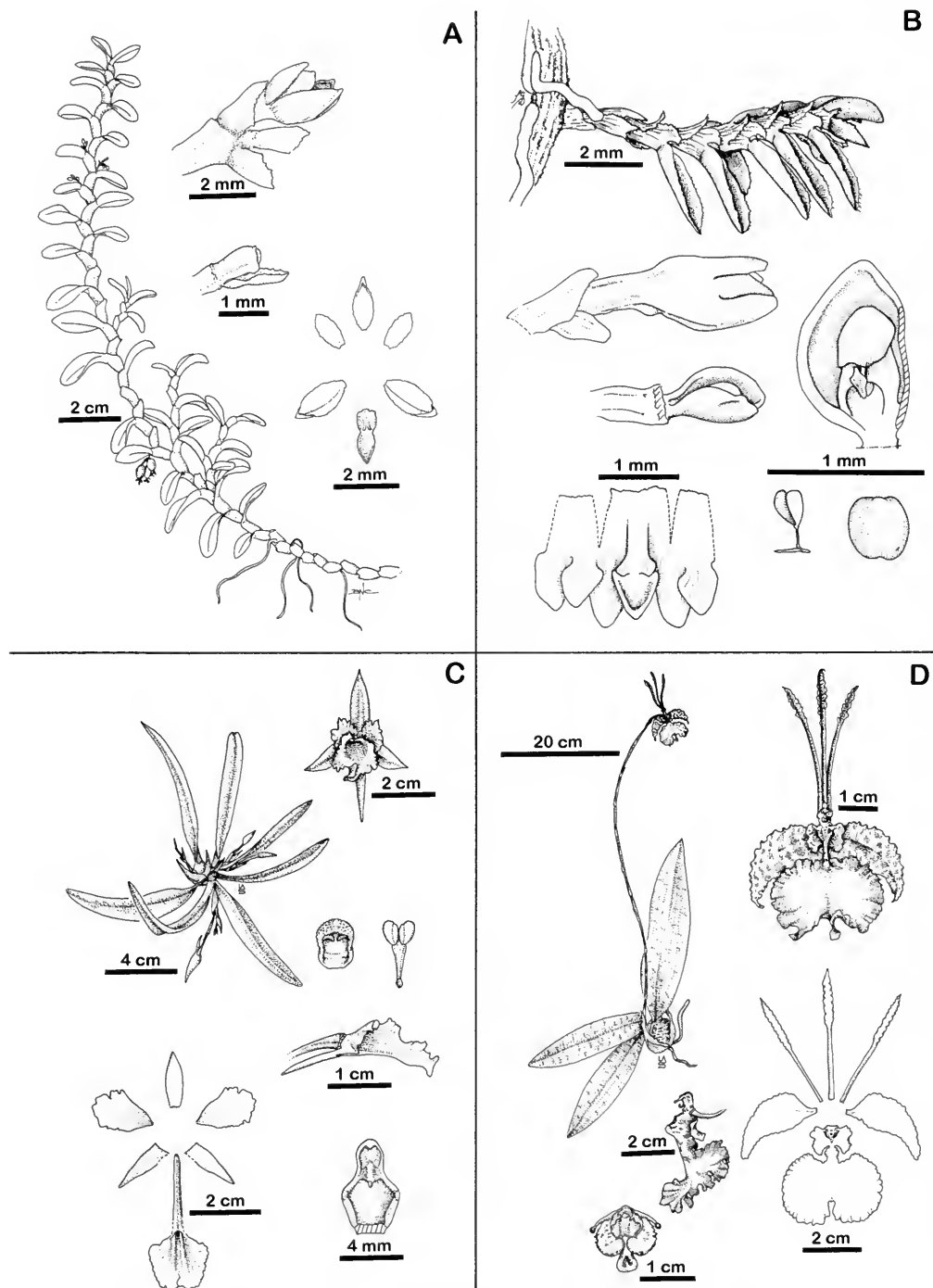


FIG. 42. **A**, *Pachyphyllum crystallinum* (Icon. Pl. Trop. 14: t. 1375 as *P. pastii*. Note: Floral diagnosis is based on a forcefully opened bud. Illustrator: B. N. Culbertson). **B**, *Pachyphyllum hispidulum* (illustrator: S. Dalström). **C**, *Plectrophora alata* (Icon. Pl. Trop. 15: t. 1479. Illustrator: L. Alfaro). **D**, *Psychopsis krameriana* (Icon. Pl. Trop. 15: t. 1486. Illustrator: L. Alfaro).

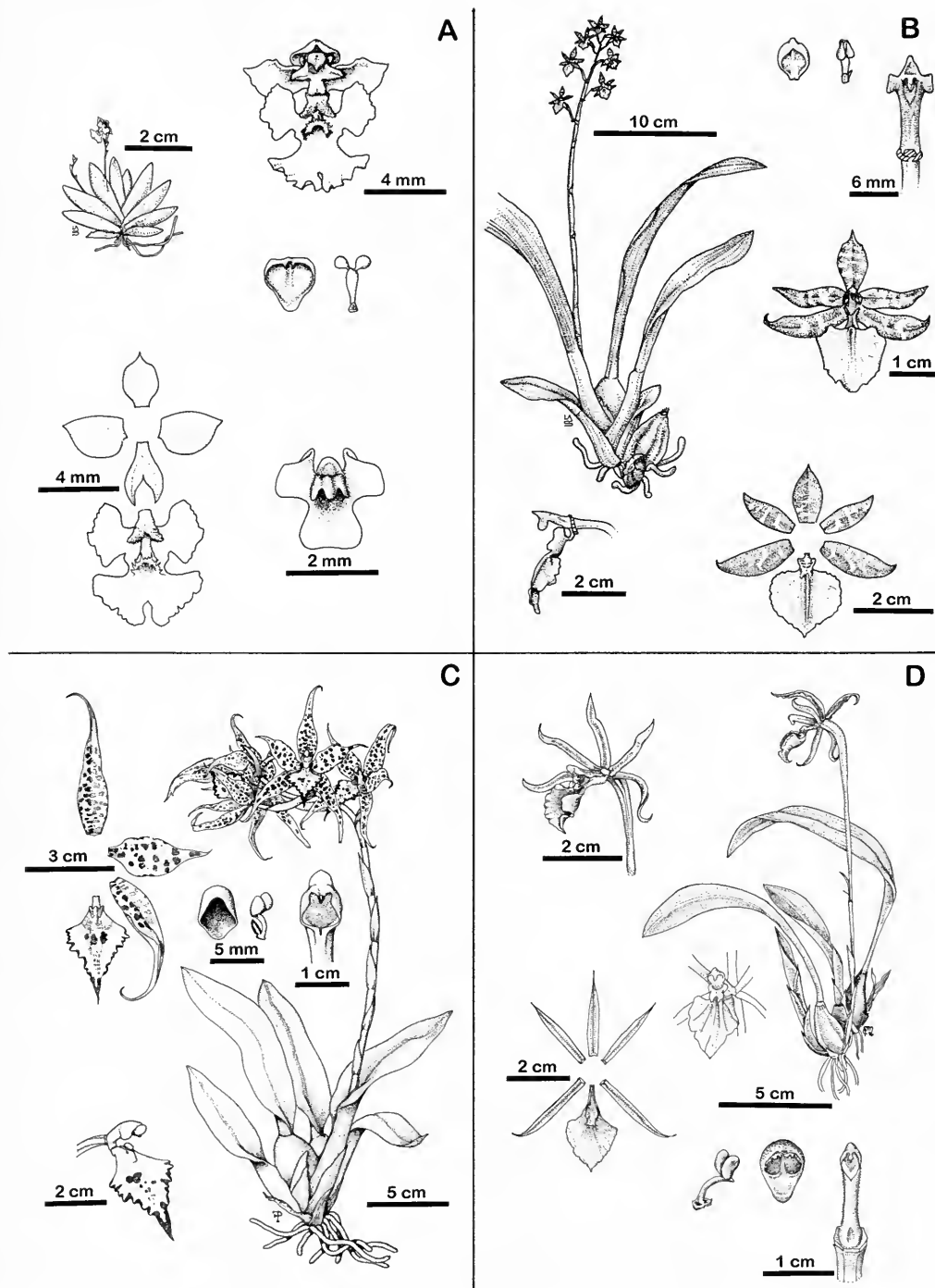


FIG. 43. **A**, *Psymmorchis pumilio* (Icon. Pl. Trop. 15: t. 1487. Illustrator: L. Alfaro). **B**, *Rhynchostele bicktoniensis* (Icon. Pl. Trop. 15: t. 1442. Illustrator: L. Alfaro). **C**, *R. hortensiae* (Icon. Pl. Trop. 16: t. 1541. Illustrator: F. Pupulin). **D**, *R. stellata* (illustrator: C. Marín).

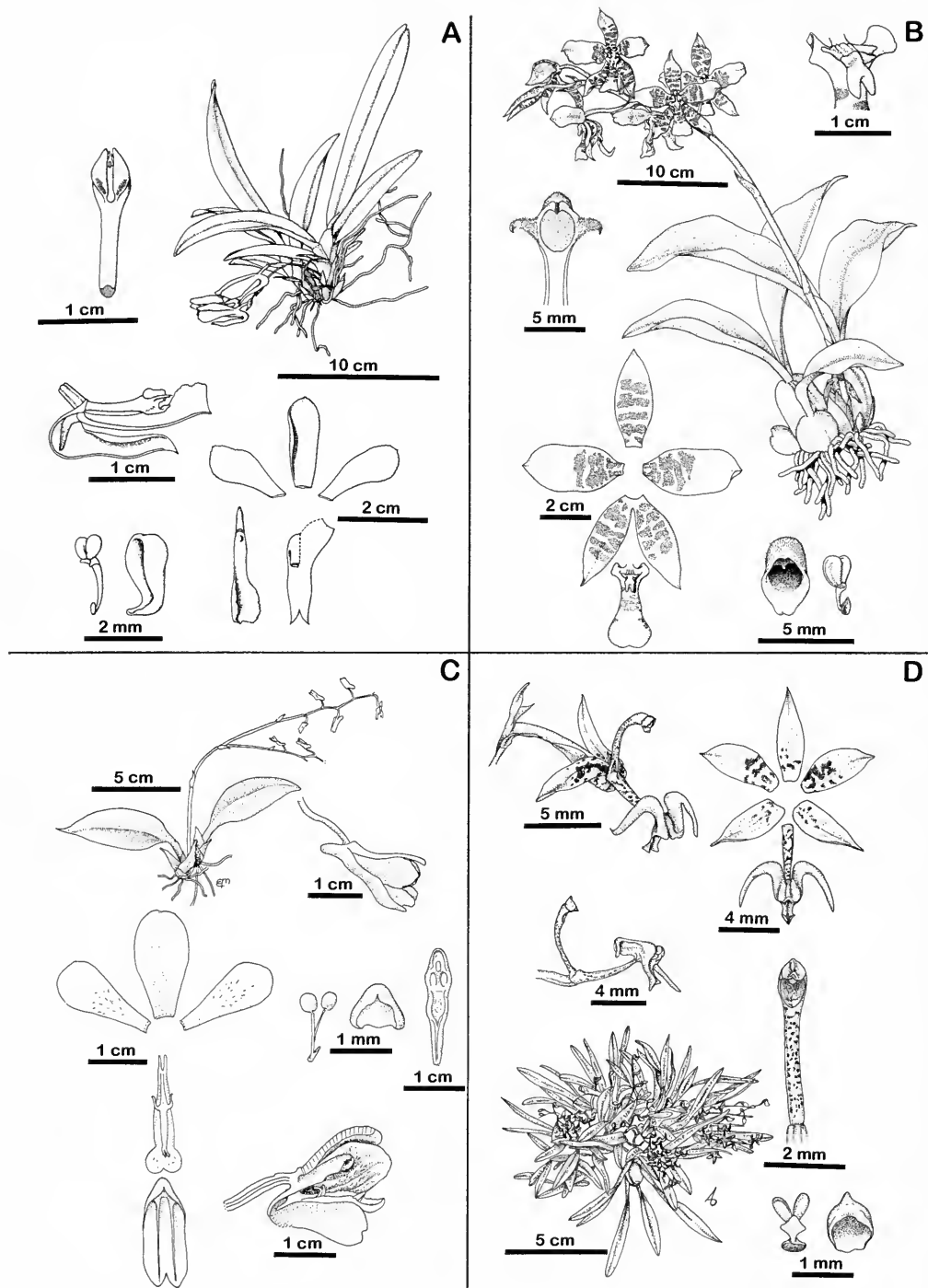


FIG. 44. A, *Rodriguezia compacta* (Icon. Pl. Trop. 16: t. 1578. Illustrator: F. Pupulin). B, *Rossioglossum schlieperianum* (Icon. Pl. Trop. 16: t. 1579. Illustrator: F. Pupulin). C, *Scelochilus aureus* (Icon. Pl. Trop. 16: t. 1585. Illustrator: C. Marín). D, *Sigmatostalix unguiculata* (illustrator: O. Achí).

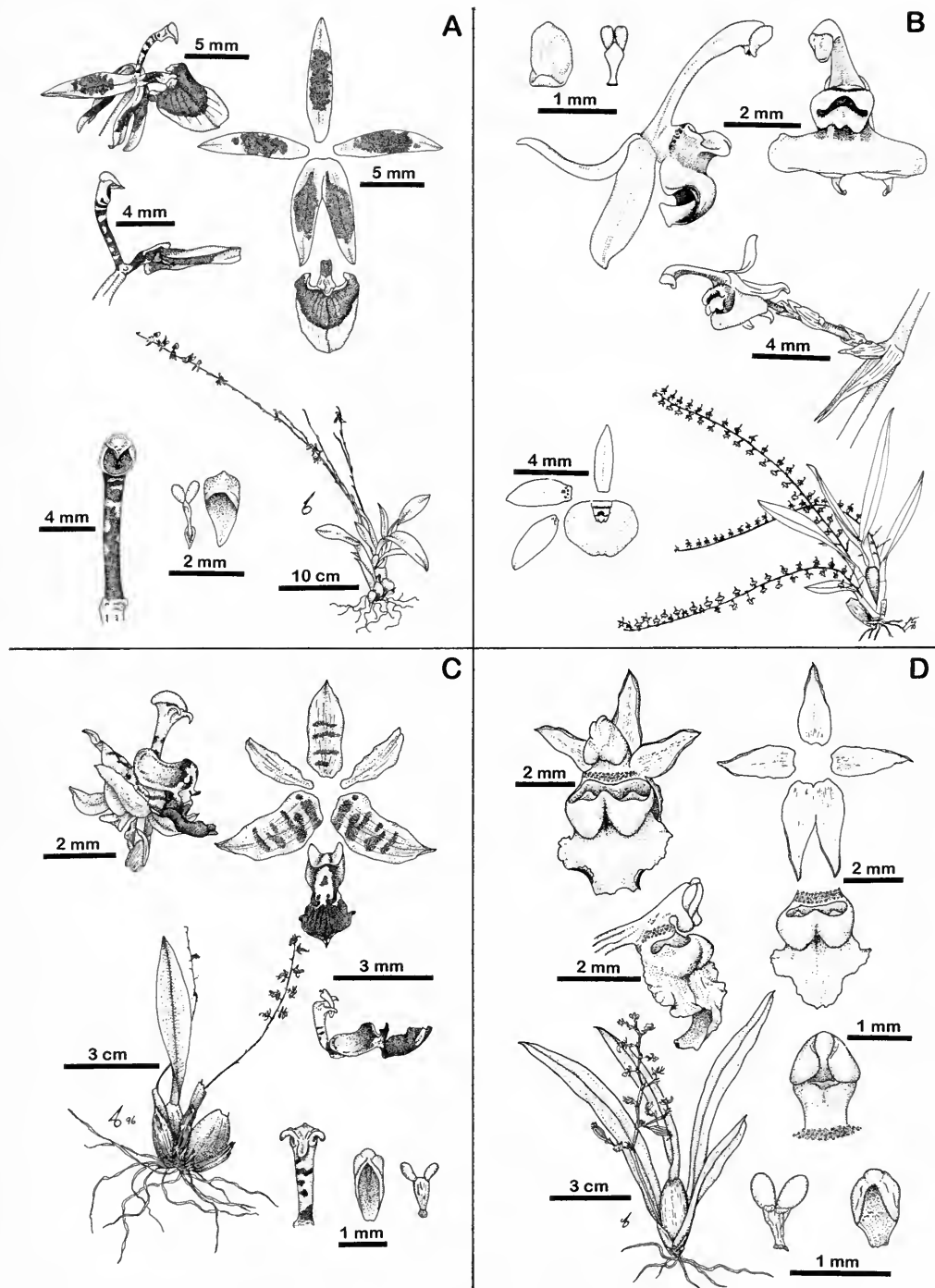


FIG. 45. A, *Sigmatostalix picta* (illustrator: O. Achf). B, *S. macrobulbon* (Icon. Pl. Trop. 16: t. 1588. Illustrator: S. Dalström). C, *S. brownii* (illustrator: O. Achf). D, *S. hymenantha* (illustrator: O. Achf).

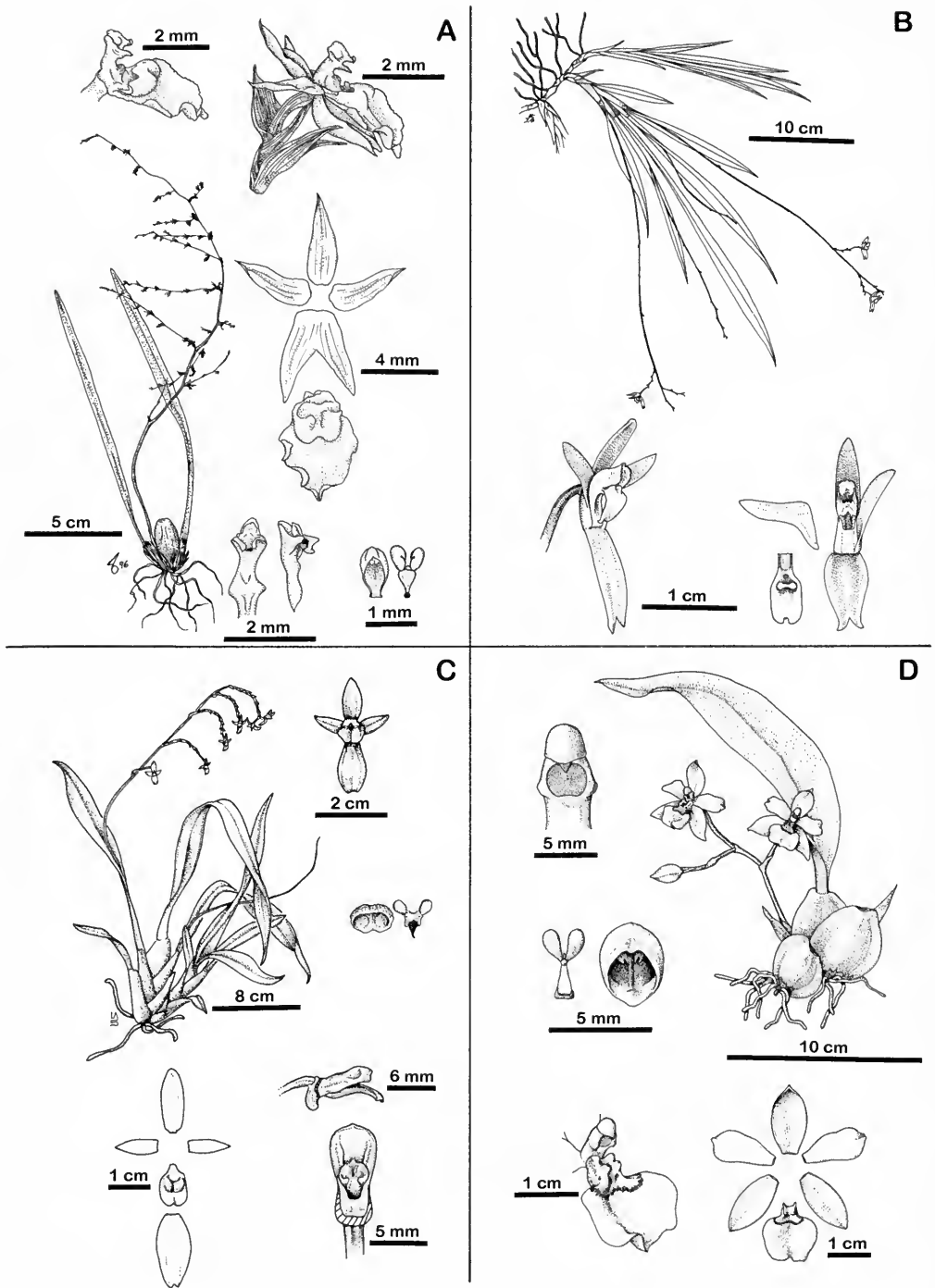


FIG. 46. **A**, *Sigmatostalix adamsii* (illustrator: O. Achí). **B**, *Systeloglossum acuminatum* (illustrator: S. Dalström). **C**, *Systeloglossum costaricense* (Icon. Pl. Trop. 15: t. 1494. Illustrator: L. Alfaro). **D**, *Ticoglossum krameri* (Icon. Pl. Trop. 16: t. 1596. Illustrator: F. Pupulin).

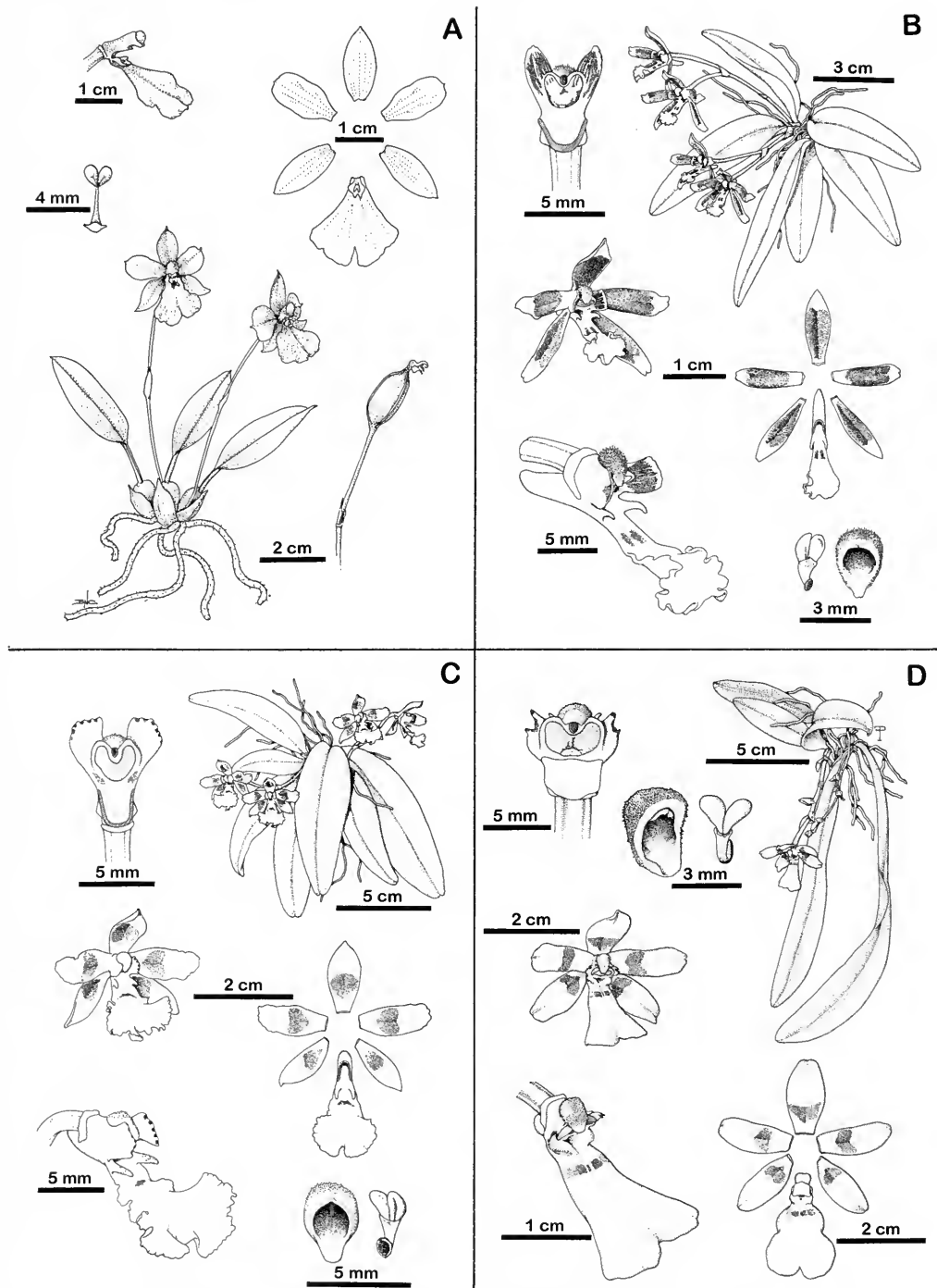


FIG. 47. A, *Ticoglossum oerstedii* (Icon. Pl. Trop. 14; t. 1398. Illustrator: B. N. Culbertson). B, *Trichocentrum dianthum* (illustrator: F. Pupulin). C, *Trichocentrum pfavii* (illustrator: F. Pupulin). D, *Trichocentrum estrellense* (illustrator: F. Pupulin).

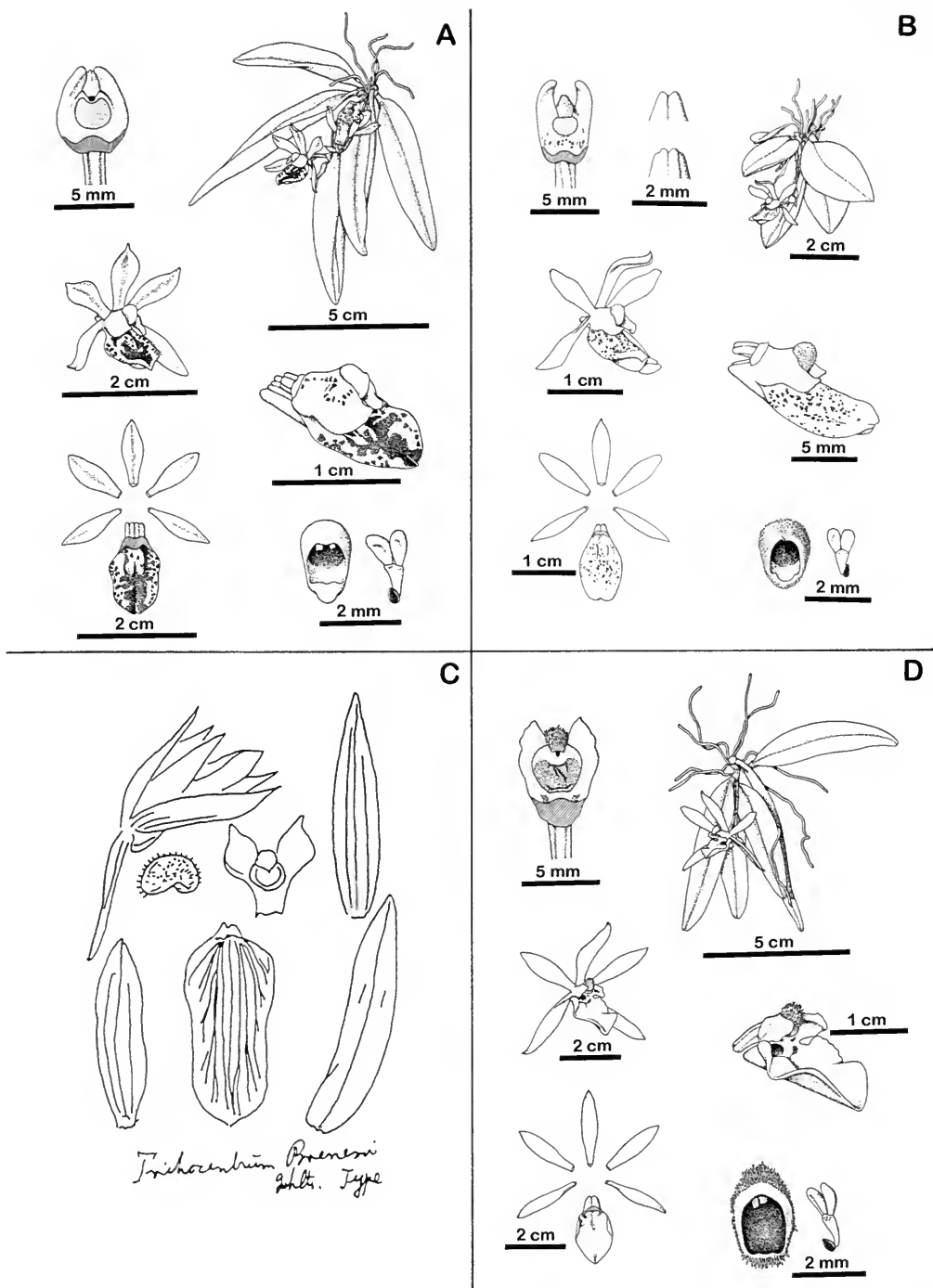


FIG. 48. **A**, *Trichocentrum caloceras* (Icon. Pl. Trop. 16: t. 1597. Illustrator: F. Pupulin). **B**, *T. costaricense* (illustrator: F. Pupulin). **C**, *T. brenesii* (Selbyana 15:97. 1994. Illustrator: F. Pupulin, redrawn from type). **D**, *T. capistratum* (Icon. Pl. Trop. 16: t. 1598. Illustrator: F. Pupulin).

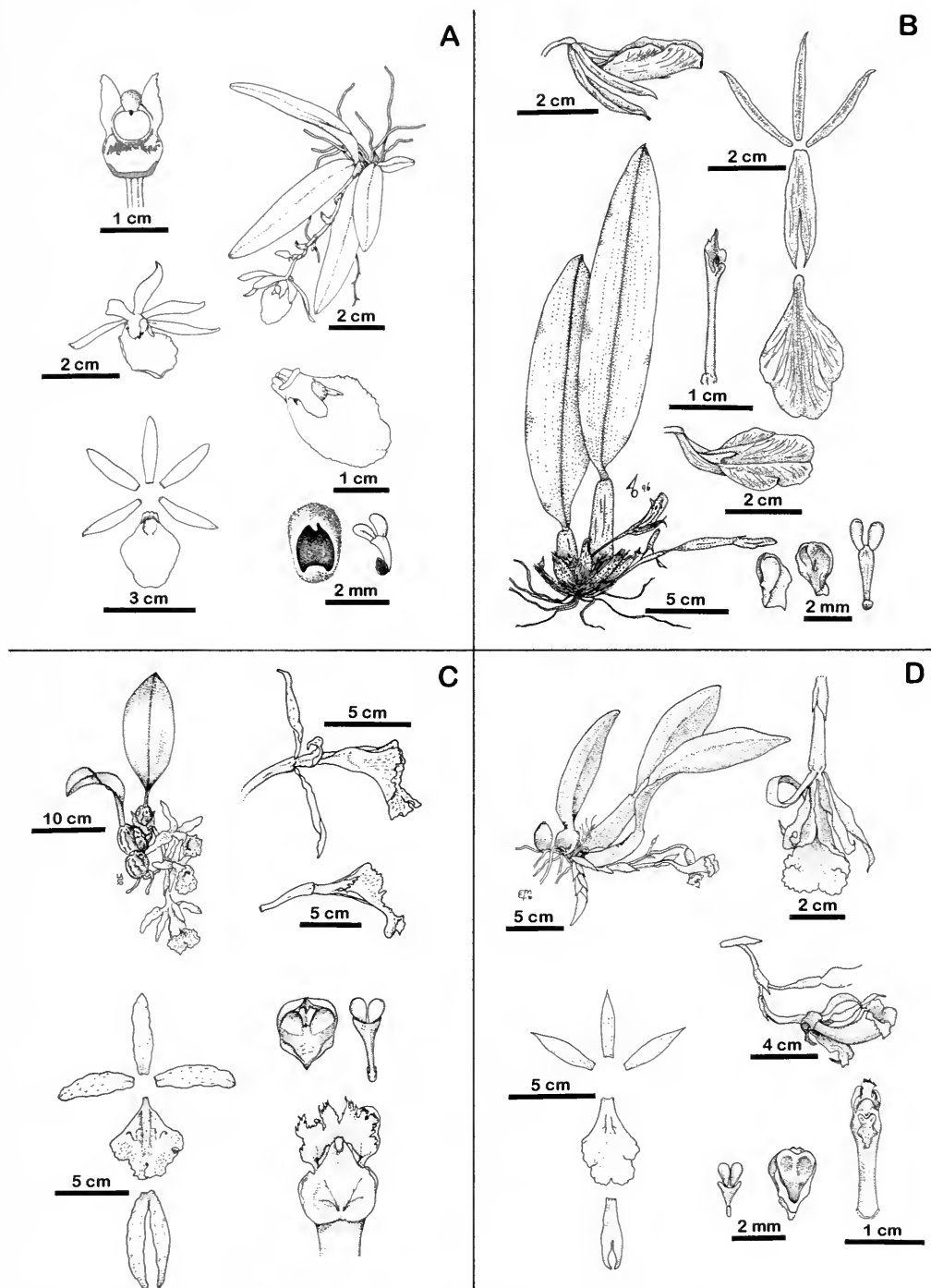


FIG. 49. **A**, *Trichocentrum cymbiglossum* (Selbyana 15: 100. 1994. Illustrator: L. Alfaro). **B**, *Trichopilia maculata* (illustrator: O. Achí). **C**, *Trichopilia suavis* (Icon. Pl. Trop. 15: t. 1498. Illustrator: L. Alfaro). **D**, *Trichopilia turialbae* (Icon. Pl. Trop. 16: t. 1600. Illustrator: C. Marín).

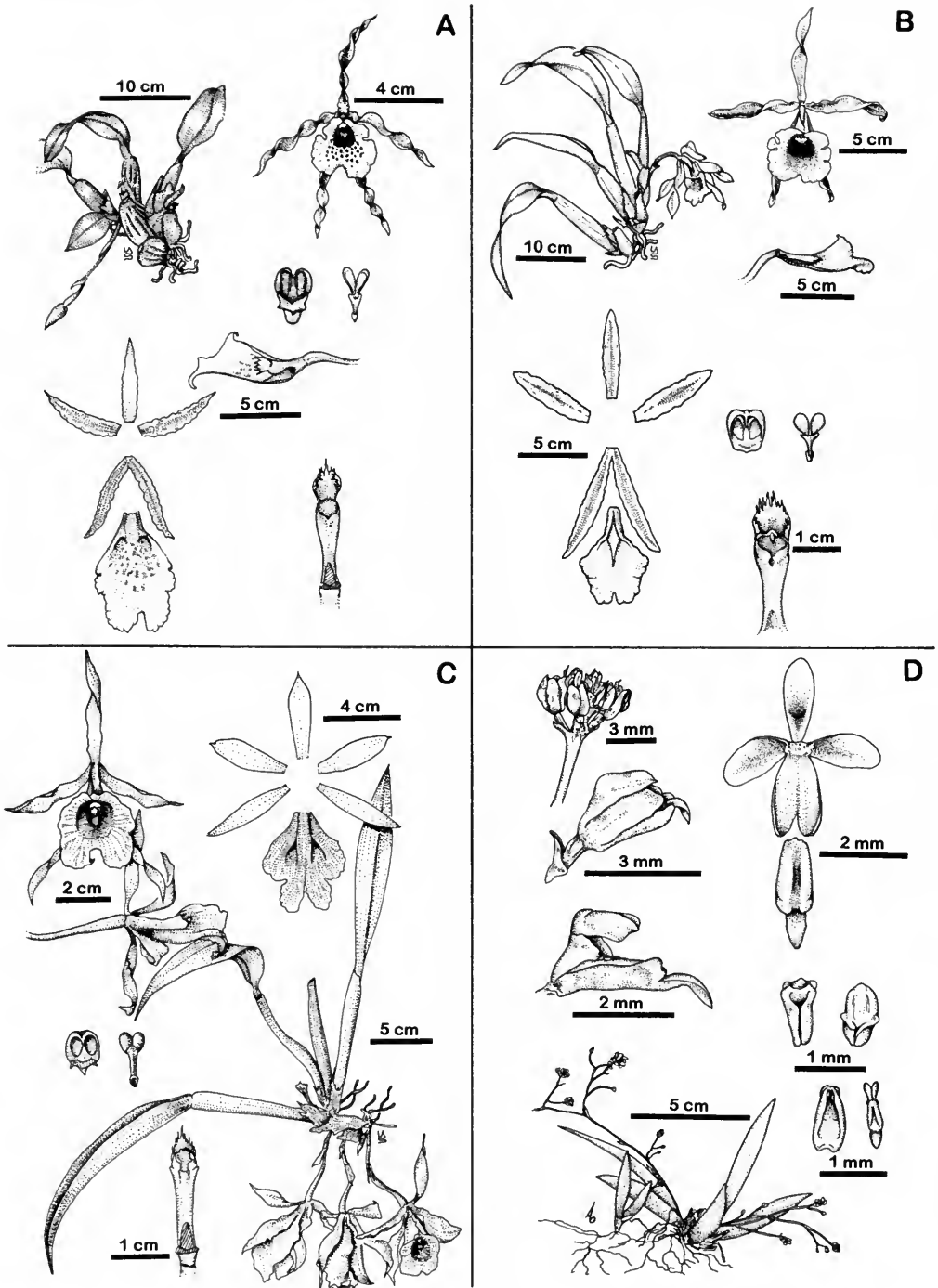


FIG. 50. A, *Trichopilia tortilis* (Icon. Pl. Trop. 15: t. 1499. Illustrator: L. Alfaro). B, *Trichopilia marginata* (Icon. Pl. Trop. 15: t. 1497. Illustrator: L. Alfaro). C, *Trichopilia galeottiana* (Icon. Pl. Trop. 16: t. 1599. Illustrator: L. Alfaro). D, *Trizeuxis falcata* (illustrator: O. Achí).

substantial shade. Flowering August to November. Nicaragua to Panama.

Ada chlorops is easy to recognize in the field by the stellate, green flowers spotted with tan on fan-shaped plants with thin, almost plicate leaves. Sterile plants appear similar to *Miltoniopsis war-sciewiczii* (Rchb. f.) Garay & Dunsterv., with which it often grows, but the latter has a much more conspicuous pseudobulb, and its leaves are more gray in color.

Amparoa Schltr.

(D. E. Mora de Retana)

Epiphytic, somewhat rhizomatous **herb** with rather thick roots. **Pseudobulbs** ovate, 1-foliate, compressed, subtended by 2 or more foliaceous bracts. **Leaf** oblong-lanceolate to somewhat elliptic, acute, thin in texture. **Inflorescence** a lateral, scapose raceme borne at the base of the pseudobulb, with 5–10 flowers; ovary with slender pedicel. **Flowers** spreading, green or yellowish green, the lip with yellow or orange. **Sepals** soft in texture, oblong-lanceolate, acute. **Petals** similar in shape but notably smaller than the sepals, linear-oblongate, porrect, acute. **Lip** somewhat fleshy, simple, straight, subpandurate, with simple callus. **Column** slender, cylindric to subclavate, without auricles; pollinia 2, with stipe and viscidium. **Fruit** a capsule.

A genus of two species ranging from Mexico to Costa Rica. One species occurs in Costa Rica.

Schlechter (Repert. Spec. Nov. Regni Veg. Beih. 19:64. 1923) separated *Amparoa* from *Odontoglossum* on the basis of the relatively small petals, rather porrect and straight lip with simple callus, and the slender column. Little is known of its relationships, but the long column suggests a relationship with *Sigmatostalix*.

Amparoa costaricensis Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:65. 1923. **TYPE**: Costa Rica, La Palma, C. Wercklé 129 (AMES, photo seen). Figure 27B.

Plant a caespitose to shortly creeping epiphyte 20–25 cm high; rhizome thick, to about 2 cm long between pseudobulbs; roots to 2.5 mm thick. **Pseudobulbs** elliptic-ovate, strongly compressed laterally and with slender margins, 4–4.5 cm long, 2.5–2.7 cm wide, the apex 1-foliate, subtended by ca. 4–6 soon deciduous, foliaceous bracts. **Leaves** coriaceous, shortly petiolate; blades elliptic-ovate, carinate, conduplicate at the base; apex acute and apiculate. **Inflorescence** scapose, 20–35 cm long (to 40 cm long in Nicaragua), with 5–10 flowers; ovary with pedicel 2–3 cm long subtended by much shorter acute bracts. **Flowers** 2–4 open at a time, spreading, yellowish

green, the lip yellow with orange-yellow callus. **Sepals** subequal, oblong-lanceolate, acute, carinate; dorsal 1.3–1.4 cm long, 3–3.4 mm wide; laterals somewhat subfalcate, 1.4–1.6 cm long, 3–3.4 mm wide. **Petals** much smaller than sepals, linear-oblongate, porrect, acute, 1–1.1 cm long, 2–3 mm wide. **Lip** simple, subpandurate, 1.3–1.4 cm long, 5–6 mm wide; with a short, semiterete claw at the base; apical portion flat, truncate, and retuse; margins entire; callus on the basal $\frac{2}{3}$ trapezoid, smooth, the base forming “shoulders,” the apex emarginate. **Column** slender, broadened above, without auricles, 1–1.1 mm long; anther with 2 pollinia, obovate, sulcate, with ovate stipe and viscidium. **Capsules** ca. 3.5 cm long; pedicel 2–3 cm long.

Middle-canopy epiphytes growing in premontane cloud forests on larger branches exposed to strong winds at 1200–1400 m. Rare from Honduras to Costa Rica. Flowering in August and September.

Vegetatively *A. costaricensis* is typical of the Oncidiinae, but the inflorescence has few flowers that have a simple lip and a similarly simple callus. The petals are notably smaller than the sepals, and the flower color is unique among Costa Rican Oncidiinae.

Alphonse Heller wrote an unpublished note that he found plants in Nicaragua at 2150 ft with a pubescent callus among other differing features. These plants may represent an undescribed species.

Aspasia Lindl.

(D. E. Mora de Retana)

REFERENCES—R. L. Dressler and N. H. Williams, An overlooked genus in the Oncidiinae. Amer. Orchid Soc. Bull. 39:988–994. 1970. N. H. Williams, Taxonomy of the genus *Aspasia* Lindley (Orchidaceae: Oncidieae). Brittonia 26:333–346. 1974.

Epiphytic, caespitose or shortly rhizomatous and creeping **herb**. **Pseudobulbs** stalked, elliptic to oblong, variously compressed laterally, subtended by 2–6 sheathing and often foliaceous bracts. **Leaves** 1–2 at the pseudobulb apex, conduplicate, usually thin. **Inflorescence** 1–2, lateral at the base of the pseudobulb, usually not exceeding the shoot, of 1–10 flowers. **Flowers** usually ringent, the base of the lip parallel to and partially united to the column by the lateral margins. **Sepals** and **petals** similar, the petals somewhat smaller and usually partially adnate to the column. **Lip** larger than sepals and petals (at least in Central American species), recurved or reflexed sharply above the claw, the callus of keels, or teeth, usually 3-lobate, the midlobe often emarginate. **Column** erect, cylindric; anther with 2 pollinia, waxy, with angular-ovate stipe with viscidium.

A genus of about six species from lower elevations differing mainly in flower size and in details of the column and lip. Two species are known in Central America, both in Costa Rica.

Williams compared *Aspasia* to several genera, including *Brassia*, and *Odontoglossum*. Dressler

and Williams removed *Aspasia pusilla* C. Schweinf. to the genus *Cischweinfia*. Chase and Palmer's work suggests a relationship with a cluster of genera including *Ada*, *Brassia*, *Cischweinfia*, *Odontoglossum*, *Otoglossum*, and *Symphoglossum*.

Key to the Species of *Aspasia*

- 1a. Sepals < 2.5 cm, brown spotted *A. epidendroides*
- 1b. Sepals > 2.6 cm, lined with brown *A. principissa*

Aspasia epidendroides Lindl., J. Bot. (Hooker) 1:6. 1834. TYPE: Panama and western Colombia, *Cuming s.n.* (κ, photo). *Odontoglossum aspasia* Rchb. f., Ann. Bot. Syst. 6:851. 1864. *Aspasia fragrans* Klotzsch, Ind. Sem. Hort. Berol. 12. 1853. *Aspasia barclayi* Rolfe, Bull. Misc. Inform. 210. 1892. Figure 27C.

Plant epiphytic, caespitose to shortly repent, forming small clumps. Rhizome stout; roots 1–1.5 mm in diameter. **Pseudobulbs** oblong-elliptic, strongly compressed laterally, 4–16 cm long, 4–6 cm wide, somewhat stipitate and hidden basally by 2–4 foliate sheaths, apically 2-foliate. **Leaves** articulate, the blade elliptic to lanceolate, conduplicate at the base and apically acute to acuminate, 8–30 cm long, 1.5–4.5 cm wide. **Inflorescences** generally 2 borne laterally at the pseudobulb base, with 4–8 successive flowers, shorter than the subtending leaf; ovary with pedicel 2–3 cm long. **Flowers** fragrant, the sepals green spotted with maroon, petals rose, and lip white, turning yellow with purple stain centrally. **Sepals** subequal, subcoriaceous, elliptic-ovate to obovate, somewhat concave, acuminate apically, 2.1–2.3 cm long, 8–10 mm wide; dorsal erect and inserted on the column; lateral-spreading and reflexed. **Petals** spreading, elliptic-ovate, somewhat spatulate, apiculate, adnate basally to the column, 2.1–2.3 cm long, 9–10 mm wide. **Lip** adnate to less than 1/3 the column, lightly 3-lobate, reflexed below the middle, 2–2.5 cm long, 1.5–2.5 cm wide, the margin lightly undulate, the apex emarginate and somewhat fimbriate; callus of 2 fleshy, longitudinal, elevated projections centrally, usually flanked by 2–4 shorter, more or less parallel calli. **Column** stout, somewhat arcuate, (1.7–)2.3 cm long; anther terminal, the anther papillose; pollinia 2, obpyriform, waxy, with prominent stipe and viscidium. **Capsule** 6–8 cm long, cylindric, pedicel 1–1.5 cm long.

A fairly common epiphyte of humid forests on larger branches and trunks at 0–750(1000) m along the Pacific slope. Flowering January to April. Reported from Guatemala and El Salvador to Colombia.

This species is easily distinguished from the similar *A. principissa* Rchb. f. by the smaller

flowers, the spotted sepals and petals, and the lip, which has a darker purple color. The synonymy is based on Williams's treatment.

Aspasia principissa Rchb. f., Bot. Zeitung (Berlin) 10:637. 1852. TYPE: Panama, Veraguas(?), Warscewicz (w 45457, photo). *Odontoglossum principissa* (Rchb. f.) Rchb. f., Ann. Bot. Syst. 6:852. 1864. *Aspasia epidendroides* Lindl. var. *principissa* (Rchb. f.) P. H. Allen, Ann. Missouri Bot. Gard. 36:165. 1949. *Aspasia bibriana* Rchb. f., Bonplandia 2:90. 1854. TYPE: Locality unknown (w). *Odontoglossum biberianum* [sic] (Rchb. f.) Rchb. f., Ann. Bot. Syst. 6:849. 1864. *Aspasia rousseauae* Schltr. Gartenflora 72:76. 1922. (lectotype: fig. 10 in Gartenflora 72:73). Figure 27D.

Plant epiphytic, to 40 cm high. Rhizome short; roots about 1.5 mm in diameter. **Pseudobulbs** oblong elliptic, compressed, stalked, 7.8–15 cm long, 3.1–3.6 cm wide, concealed at the base by 2–3 foliaceous sheaths, apically 2-foliate. **Leaves** subcoriaceous, deciduous, elliptic-lanceolate to oblanceolate, conduplicate at the base, acute, the blade 10–41 cm long, 1.3–3.8 cm wide. **Inflorescence** a lateral 4–6 successive-flowered raceme; ovary with pedicel about 3 cm long subtended by subulate bracts to 1.4 cm long. **Flowers** about 4.5 cm high and 2.5 cm wide in natural position, with greenish yellow sepals and petals; sepals with diffused bars of reddish brown, the petals longitudinally marked with the same color; lip white turning yellow, stained centrally or lined with magenta and with a yellow callus. **Sepals** subequal, elliptic-lanceolate, lightly concave, apiculate and thickened at the apex; dorsal erect, inserted on the back of the column, 2.8–3 cm long, 7–9 mm wide. **Petals** elliptic-lanceolate, carinate, enlarged and involute apically, united to the base of the column, the apex emarginate, and with a fleshy apicule; lateral sepals subfalcate, with lightly undulate margins, 2.6 cm long, 7 mm wide. **Lip** pandurate when spread, united to nearly 1/2 the column, 2.5–3.5 cm long, 2–2.8 cm wide; callus of a pair of fleshy lamellate keels from the base to about the middle. **Column** stout lacking wings apically, 2–2.5 cm long; anther terminal, the anther lightly papillose; pollinia 2,

obovoid with well-developed stipe and viscidium. **Capsule** cylindric, about 8 cm long, with pedicel about 1.5 cm.

Epiphytic in lowland tropical rain forests between 10 and 300(500) m on the Atlantic slope, where it grows on the larger, shaded branches of the host. Flowering December to April. Reported from Nicaragua(?), Costa Rica, Panama, and Colombia.

This species closely resembles *A. epidendroides* but differs in the larger flower, in the sepals and petals with brown lines rather than spots, in the much more constricted lip, and in the much deeper anther. The synonymy given above follows that of N. Williams.

Brassia R. Br.

(D. E. Mora de Retana)

REFERENCE—N. H. Williams, A reconsideration of *Ada* and the glumaceous brassias (Orchidaceae). *Brittonia* 24:93–110. 1972.

Key to the Species of *Brassia*

- 1a. Pseudobulb apex with a single leaf *B. arcuigera*
- 1b. Pseudobulb apex with ≥ 2 leaves
 - 2a. Lip with conspicuous raised warts *B. verrucosa*
 - 2b. Lip lacking warts
 - 3a. Lip rhombic, at least 2 cm wide; petals with solid dark pigment on the lower third; pseudobulbs tapering apically *B. gireoudiana*
 - 3b. Lip lanceolate to ovate, < 2 cm wide; petals at most spotted on lower $\frac{1}{3}$; pseudobulbs fusiform to oblong *B. caudata*

Brassia arcuigera Rchb. f., Gard. Chron. (1869) 388. TYPE: Peru, *Veitch* (w, photo). ***Brassia antherotes*** Rchb. f., Gard. Chron. 12:782. 1879. TYPE: Colombia, Dagua, *E. Klaboch* (w, photo). ***Brassia lawrenceana*** Lindl. var. *longissima* Rchb. f., Gard. Chron. 1313. 1868. TYPE: *Buller s.n.* (w, photo). ***Brassia longissima*** (Rchb. f.) Nash, Bail. Stand. Cyclop. Hort. 1:541. 1914. ***Brassia antherotes*** Rchb. f. var. *longissima* (Rchb. f.) Teuscher, *Baileya* 9:121–124. 1961. Figure 28A.

Plant epiphytic, rarely terrestrial, caespitose, forming small clumps to ca. 40 cm. Rhizome short; roots to 3 mm in diameter. **Pseudobulbs** ovoid to elliptic-oblong, strongly

caespitose or repent epiphytic **herb**, usually with well-developed **pseudobulbs** subtended by sometimes foliaceous bracts, the apex with 1–3 leaves. **Leaves** conduplicate, lanceolate, elliptic to oblanceolate. **Inflorescence** an arcuate, several- to many-flowered raceme borne laterally at the base of the pseudobulb. **Flowers** large and conspicuous, subtended by small elongate spatheaceous bracts. **Sepals** free, narrowly attenuate to caudate, sometimes of equal length but usually the dorsal much shorter. **Petals** similar to the dorsal sepal but usually shorter. **Lip** simple or obscurely lobed, forming more than a right angle with the column. **Column** short, stout, and erect, lacking wings; anther terminal, pollinia 2, waxy. **Fruit** a capsule.

A Neotropical genus of about 38 species differing from *Oncidium* mainly by its attenuate floral segments. Four species are known in Costa Rica. Norris Williams separated plants once assigned to the glumaceous section of *Brassia* into the genus *Ada* on the basis of the smaller pseudobulbs, leaves with several major veins, the often several inflorescences per shoot, the large sheathing leaves, and different pollinarium. According to Chase and Palmer, DNA evidence suggests relationships with *Aspasia*, *Cischweinfia*, and possibly some species of *Odontoglossum* and *Symphoglossum*.

compressed laterally and sharp-edged, 6–14 cm long, 2.5–4.5 cm wide, apically 1-foliate, protected at the base by 0–1 foliaceous sheaths. **Leaves** articulate, subcoriaceous, elliptic, conduplicate at the base, acute, prominently keeled abaxially, 20–40 cm long, 4–6 cm wide. **Inflorescence** an arcuate raceme with numerous flowers borne at the base of the pseudobulb, 25–45 cm tall including the scape, the nodes with triangular acute bracts; ovary with pedicel 1.5–3 cm long. **Flowers** “spidery” in shape, very variable in size, pleasantly fragrant in Costa Rican populations, distichous, greenish white turning orange-yellow, with reddish brown spots at the base of the sepals, to 30 cm tall, 7 cm wide. **Sepals** similar, free, linear-lanceolate, attenuate, the dorsal erect, to about 10 cm long, 4–5 mm wide; lateral 8–21 cm long and 5–6 mm wide. **Petals** much shorter than sepals, free, linear-lanceolate, lightly falcate, attenuate, 4–6 cm long, 4–6 mm wide. **Lip** simple, ovate-lanceolate, acuminate, the margins smooth, 5–6 cm long, 1.2–1.5 cm

wide; callus at the base consisting of a pair of white, elevated keels between which is a median, yellow-orange, pubescent furrow. **Column** stout, 7–9 mm long; anther with 2 pollinia, waxy, obpyriform, with viscidium and broad stipe.

Epiphytic, rarely terrestrial on embankments in premontane rain forests at 500–1600 m. Flowering in Costa Rica mostly March to October. Reported from Costa Rica to Peru and Venezuela.

This species is the largest-flowered *brassia* in Costa Rica. It is most similar to *B. caudata*, which occurs at much lower elevations, and the pseudobulbs of that species are apically 2-foliate with rounded edges. We are following authors in recognizing the above synonymy.

***Brassia caudata* (L.) Lindl., Bot. Reg. 10: t. 832. 1824. *Epidendrum caudatum* L., Sp. Pl. (ed. 2) 1349. 1763. *Malaxis caudata* Willd. Sp. Pl. (ed. 4) 4:93. 1805. *Oncidium caudatum* Rchb. f., Ann. Syst. Bot. 6:766. 1863. *Brassia caudata* var. *hieroglyphica* Rchb. f., Ill. Hort. 28:20. 1881. TYPE: “La Perle des Antilles” (w, photo). Figure 28B.**

Plant epiphytic, caespitose to 35 cm high. Rhizome short; roots to 2.5 mm in diameter. **Pseudobulbs** fusiform to oblong, somewhat compressed, 6–10 cm long, 1.5–2.5 cm wide, subtended at the base by foliaceous bracts when young, apically 2-foliate. **Leaves** elliptic oblong to somewhat oblanceolate, coriaceous, carinate abaxially, 10–20 cm long, 2.5–4.5 cm wide, apex acute. **Inflorescence** a lateral arcuate raceme of 6–12 distichous flowers, to about 30 cm long including the scape; ovary with pedicel 1–2 cm long. **Flowers** “spidery” with spreading segments very variable in attenuation, greenish yellow turning orangish with age, marked with maroon; lip white turning yellow with wine red spots. **Sepals** dissimilar, free, linear-lanceolate, attenuate; dorsal erect and with incurved apex, to 7(12) cm long, 5–8 mm wide; lateral sepals 12–20(33) cm long, 5–7 mm wide. **Petals** lanceolate, falcate, attenuate, 2.5–5.3 cm long, 3–5 mm wide. **Lip** simple, oblong lanceolate, acuminate, 3–4.5(5.5) cm long, 1.2–1.5 cm wide; callus of 2 longitudinal, pubescent keels, each terminated by a recurved tooth and between which is a pubescent furrow. **Column** stout, 3–5 mm long; anther cucullate; pollinia 2, obpyriform, with stipe and viscidium. **Capsules** 4–5 cm long including the beak, pedicel about 1.5 cm long.

This species grows in tropical lowland rain forests at 0–200 m, where it is usually uncommon though widespread. Flowering in Costa Rica mostly March to July. Reported from Florida, Cuba, and Jamaica and from Mexico and Central America to Bolivia and northern South America.

Brassia caudata is most similar to *B. arcuigera* Rchb. f., a species that has 1-foliate, sharp-edged pseudobulbs and occurs at higher elevations.

Also, the flowers of that species average larger in Costa Rican populations.

Available specimens from the Atlantic drainage have flowers that match very well Linnaeus’s concept based on the plate by Plumier. Two herbarium sheets (AMES) based on a plant collected at Pigres on the Pacific Coast by C. Lankester have much larger flowers (lateral sepals 33 cm long) and may represent natural hybrids or a different, perhaps unnamed species.

***Brassia gireoudiana* Rchb. f. & Warsc., Allg. Gartenzeitung 22:273–274. 1854. TYPE: Warscewicz (not seen). Figure 28C.**

Plant a somewhat scandent epiphyte. Rhizome elongate, 3–4 cm between shoots, covered by dark bracts; roots fleshy, to 2.5 mm in diameter. **Pseudobulbs** elliptic-ovoid, tapering, little compressed laterally, 6–14 cm long, 2.5–4.5 cm wide, subtended by 1 or more foliaceous bracts when young, becoming deciduous with age, apically 2(rarely 1)-foliate, the second leaf borne higher than the first. **Leaves** petiolate, subcoriaceous, carinate beneath, elliptic-ovate, 20–35 cm long, 2.2–5 cm wide, acute and apiculate apically. **Inflorescence** a lateral, arcuate raceme of 1–15 flowers neatly arranged on the axis, 75–100 cm long including the scape, borne at the base of the immature to mature shoot; ovary with pedicel 1.8–3 cm long. **Flowers** large and spectacular, 20–25 cm high, greenish white with brown dots at the base of the sepals, the base of the petals solid dark brown; lip greenish white with brown spots. **Sepals** similar, free, linear-lanceolate, attenuate to the apex; dorsal erect, 10–13 cm long, 4–5 mm wide; lateral sepals 11–20 cm long, 4–5 mm wide. **Petals** similar to sepals but shorter, 5–10 cm long, 4–5 mm wide, linear-lanceolate, subfalcate. **Lip** simple rhombic, narrowed at the base forming a narrow claw united to the base of the column, the apex acuminate, the margins lightly crisped, 3.5–7 cm long, 2–3 cm wide; callus at the base fleshy, a pair of keels, somewhat pubescent at the base, rounded and elevated apically. **Column** stout, 5–6 mm long, somewhat broadened apically; anther with 2 waxy, ovoid, furrowed, pollinia supported on a stipe and viscidium.

Brassia gireoudiana grows in semideciduous to evergreen premontane forests at 500–1000 m at least on the Pacific slope of southern Costa Rica. Flowering February to May. Southern Costa Rica and adjacent Chiriquí, Panama.

This species can be confused with *B. verrucosa* Lindl. but lacks the warts on the lip of that species, and the inflorescence often forms on immature shoots.

Brassia gireoudiana is apparently closely related to Brazilian *B. arachnoidea* Barb.-Rodr. Both species share nearly identical color patterns in the flowers and a similar rhombic lip. Also, the pseudobulbs are little compressed laterally.

Brassia verrucosa Lindl., Bot. Reg. 26: misc. 36. 1840. Figure 28D.

Plant epiphytic, caespitose, forming small clumps, to about 65 cm tall. Rhizome short; roots to 3 mm in diameter. **Pseudobulbs** ovoid-conic, furrowed, little compressed laterally, 6–11 cm long, 3.1–4 cm wide, subtended by 1–2 foliaceous bracts, apically 2-foliate. **Leaves** coriaceous, conduplicate at the base, the apical leaves shortly petiolate, the blade elliptic-lanceolate, acute, 16–30 cm long, 2.6–4.5 cm wide. **Inflorescence** a lateral, erect, or arcuate raceme of 6–10 flowers in Costa Rican populations, 50–65 cm long including the scape; ovary with pedicel 2.5–3 cm long, subtended by much shorter subulate bracts. **Flowers** attractive, pleasantly fragrant in Costa Rican populations, to 25 cm high, distichous, yellowish white with bars and spots of reddish brown on the sepals and petals, olive green warts on the lip. **Sepals** similar, free, linear-lanceolate, attenuate and somewhat canaliculate; dorsal erect, 6.5–13.5 cm long, 6–7 mm wide; lateral sepals 7.5–17.5 cm long, 6–7 mm wide. **Petals** linear-lanceolate, falcate, attenuate, 4–9 cm long, 6–7 mm wide. **Lip** obscurely 3-lobate, trullate-subpandurate, broadest just below the middle, acuminate at the apex, verrucose below, 3.5–5.2 cm long, 2.4–3.2 cm wide; callus a pair of keels on the lower ¼, each keel terminated by a tooth. **Column** erect, 7 mm long; anther with 2 pyriform, sulcate pollinia with stipe and viscidium.

Brassia verrucosa is a species of evergreen to semideciduous cloud forests at 1300–1800 m, where it grows on trunks and larger branches of its host. Flowering December to May. Reported from Mexico to Costa Rica.

Plants observed from northern Nicaragua have smaller and usually more numerous flowers with a rather unpleasant odor compared to those from Costa Rica. Also, Costa Rican plants have fewer warts on the lip than those farther north. We hesitate to repeat the synonymies given by authors because

some of them may prove to be different. Although the type of *B. verrucosa* was not determined, a specimen on microfiche, identified by Lindley as the species, was seen.

Cischweinfia Dressler & N. Williams

(D. E. Mora de Retana)

REFERENCE—R. L. Dressler and N. H. Williams, An overlooked genus in the Oncidiinae. Amer. Orchid Soc. Bull. 39:988–994. 1970.

Cespitose, usually small epiphytic herbs. **Pseudobulbs** usually ellipsoid to ovoid, 1-foliate, compressed, subtended by 1 or more foliaceous sheaths. **Leaves** conduplicate, carinate, elliptic to lanceolate, acute, thin in Costa Rican species. **Inflorescence** a lateral raceme, shorter than the subtending foliaceous bract in Costa Rican plants, with 1–5 flowers. Flowers spreading, usually attractive. **Sepals** and **petals** free, similar. **Lip** simple, with basal margins usually clasping the column. **Column** with a pair of auricles beneath the stigma, with distinct hood-shaped and often petaloid anther bed; anther often papillose; pollinia 2 supported on an elongate stipe with viscidium. **Fruit** a capsule.

A Neotropical genus of about nine species ranging from Costa Rica to South America. There are two species in Costa Rica.

Cischweinfia was described by Dressler and Williams to accommodate species previously classified in the genera *Aspasia*, *Miltonia*, and *Trichopilia*. Chase and Palmer published two cladograms suggesting relationships with *Ada*, *Aspasia*, *Brassia*, and possibly several other genera as well.

Key to the Species of *Cischweinfia*

- 1a. Lip surrounding column at base, tepals green suffused with pink; lip white with pink spots *C. dasyandra*
- 1b. Lip cuneate, not surrounding the column, tepals brown with yellowish green apex; lip white with yellowish orange at the base. *C. pusilla*

Cischweinfia dasyandra (Rchb. f.) Dressler & N.Wms., Amer. Orchid Soc. Bull. 39:991. 1970. *Trichopilia dasyandra* Rchb. f., Xen. Orch. 3: 64, t. 230. 1883. TYPE: Costa Rica, *Endres* (w). Figure 29A.

Plant epiphytic, caespitose. Rhizome short, the roots slender, 1–1.5 mm in diameter. **Pseudobulbs** oblong,

compressed, 3–8 cm long, 6–11 mm wide, apically 1-foliate, subtended by 2–3 foliaceous bracts. Leaves linear-lanceolate, conduplicate at the base, acute, keeled abaxially, 9–20 cm long, 7–12 mm wide. **Inflorescence** a short, somewhat pendulous 1–4-flowered raceme borne from the base of the pseudobulb, 4–7 cm long, ovary and pedicel 13–20 mm long. **Flowers** with green sepals and petals suffused with pink, the lip white with pink spots and yellow in the center, 2.4–2.7 cm long and 1.8–2.2 cm wide in natural position. **Sepals** subequal,

free, elliptic-lanceolate, acute, 1.2–1.4 cm long, 2–3 mm wide; lateral subfalcate and somewhat larger than the dorsal. **Petals** elliptic-oblong, acute, subfalcate, 1–1.2 cm long and 2–3 mm wide. **Lip** with basal margins folded around the column, obovate to suborbicular when spread, emarginate, 1–1.2 cm long and 9–10 mm wide, the margins crenulate; callus basal, glabrous, yellow, with 2 small keels. **Column** 5–7 mm long, erect, semiterete, white, with a prominently dentate to fimbriate anther bed; pollinia 2, orbicular translucent, with narrow stipe and elongate viscidium; stigma bilobed.

Uncommon epiphyte of wet premontane forests at 700–1100(1650) m. Flowering mostly June to September. Costa Rica and Panama; reported also from Colombia and Ecuador.

This species is distinguished from similar *C. pusilla* (C. Schweinf.) Dressler & N. H. Williams by the smaller plants, larger flowers of different color, and overlapping sides of the lip base folded around the column.

Cischweinfia pusilla (C. Schweinf.) Dressler & N. H. Williams, Amer. Orchid Soc. Bull. 39: 992. 1970. *Aspasia pusilla* C. Schweinf., Bot. Mus. Leaflet. 10:21–23, t. 1. 1941. TYPE: Panama, Darien, M. E. & R. A. Terry 1502 (holotype: AMES, photo; isotype: F). *Trichopilia pusilla* (C. Schweinf.) Garay, Orquideologia 5:20. 1970. Figure 29B.

Plant a caespitose epiphyte sometimes forming large clumps, 20–25 cm high; rhizome short; roots to 1.5 mm in diameter. **Pseudobulbs** elliptic-ovate, compressed, 1-foliate, 3–3.5 cm long, 1–2.1 cm wide, concealed at the base by 2–3 foliaceous bracts. **Leaves** coriaceous, carinate, with prominent conduplicate petiole; blade elliptic-lanceolate, 10–20 cm long, 1–1.5 cm wide, acute. **Inflorescence** 1–2, lateral at the base of the pseudobulb, about ½ as tall as the plant, 8–10 cm long; lax raceme of 4–5 flowers; ovary with pedicel 2.5–3 cm long, subtended by a triangular, acute bract to 8 mm long. **Flowers** with brown tepals with lemon yellow apices; lip white with yellow-orange lines at the base. **Sepals** similar, oblong-elliptic, dorsally carinate, 1.1–1.3 cm long, 3–4 mm wide, the apex acute, apiculate; dorsal erect; lateral sepals subfalcate. **Petals** similar to the sepals, oblanceolate-elliptic, 9–11 mm long, 3–3.5 mm wide, oblique at the base, the apex acute. **Lip** cuneate, simple, suborbicular to obovate when spread, 1.1–1.3 cm long, 1–1.2 cm wide, adnate basally to the middle of the column, rounded. **Column** short, 5 mm long, with a pair of auricles below the stigma; anther bed petaloid, irregularly dentate, forming a hood; anther papillose, triangular in profile; pollinia 2, obovate with elongate stipe and viscidium.

A poorly known and rare epiphyte of tropical humid forests at 600–700 m. Flowering June to

August. Costa Rica and Panama; probably also in Colombia.

Cischweinfia pusilla closely resembles *C. dasyandra* but differs notably in the cuneate lip, which does not enclose the column, and in flower color.

Comparettia Poeppig & Endl.

(D. E. Mora de Retana)

REFERENCE—I. Bock, Revision der Gattung *Comparettia* Poepp. & Endl. (part 1). Orchidee (Hamburg) 37:193–196. 1986.

Epiphytic, caespitose **herb** often forming small clumps. **Pseudobulbs** cylindric, small, often hidden by subtending foliaceous bracts, apex 1-foliate. **Leaves** subcoriaceous, conduplicate, usually ovate to elliptic, obtuse to acute, petiole essentially none. **Inflorescence** a laterally borne raceme or panicle, usually with long scape; ovary distinctly pedicellate, subtended by short, triangular bracts. **Flowers** brightly colored. **Sepals** dissimilar, the dorsal free, the lateral sepals connate and forming a conspicuous single spur. **Petals** ovate, usually acute. **Lip** much longer than the tepals, with a bifid appendage at the base inserted within the sepaline spur, the lamina conspicuously emarginate to 2-lobate. **Column** stout, usually with broadened stigma; anther with 2 pollinia supported on a slender stipe with viscidium. **Fruit** a capsule.

A genus of 10–12 vegetatively similar species distributed throughout the neotropics. Only a single species occurs in Costa Rica. The genus is easily recognized by the brilliantly colored, probably bird-pollinated flowers with large, emarginate to 2-lobate lip and conspicuous sepaline spur.

According to Chase and Palmer, *Comparettia* is closely related to *Rodriguezia* and *Scelochilus* but surprisingly not to *Ionopsis*.

Comparettia falcata Poeppig & Endl., Nov. Gen. Sp. 1:42, t. 73. 1836. TYPE: Peru, between Cassapi and Pampayacu, *Poeppig 1646* (not seen). *Comparettia rosea* Lindl., Edwards's Bot. Reg. 26: misc. 78. 1840. TYPE: "Spanish Main," drawing based on *Loddiges 752* (κ). Figure 29C.

Plant epiphytic, caespitose, forming small clumps. Rhizome short, the roots stout, much branched, 1–1.5 mm in diameter. **Pseudobulbs** cylindric, 1-foliate, 1.5–2.5 cm long, 7–10 mm broad, green suffused with purple, subtended by papery bracts. **Leaves** variable, elliptic, coriaceous to somewhat fleshy, the apex rounded and apiculate or bluntly acute, 5.5–19 cm long, 1.5–5.5 cm

wide. **Inflorescence** lateral, 15–55 cm long including the scape and panicle, rarely subtended by a foliaceous bract; ovary and pedicel about 1.5–2 cm long. **Flowers** purplish red or pink with white centrally, 2–2.3 cm high and 1.5–0.7 cm wide in natural position. **Sepals** dissimilar; the dorsal free, elliptic-lanceolate, acuminate, 10–12 mm long and 4–6 mm wide; lateral connate for their entire length, forming a spur at the base, 2.2–2.4 cm long including the spur, 5–6 mm wide. **Petals** free, obovate, the apex rounded, apiculate, 11–12 mm long, 5–7 mm wide. **Lip** obscurely 3-lobulate, 1.3–1.5 cm long and 1.4–1.6 cm wide, the lateral lobes small, subtriangular; midlobe reniform, deeply emarginate, contracted at the base, forming a claw united by its margins and central keel to the column and extending at the base into 2 filiform appendages; disk glabrous and somewhat fleshy with a white callus. **Column** stout, 4–5 mm long, broadened above, with a pair of wings near the apex; anther with 1 cell; pollinia 2, waxy, with conspicuous stipe and viscidium; stigma entire, somewhat bilobed. **Capsules** variable depending on plant size, 2–5 cm long including the conspicuous beak, with pedicel 0.8–1.7 cm.

Epiphytic on small branches and trunks in open canopies of premontane and lower montane forests at 800–2000 m. *Comparettia falcata* is one of few orchids that colonize twigs of guava trees. Flowering mostly May to August, September to November, and probably sporadically throughout the year. Widespread throughout the neotropics.

Comparettia falcata is easily identified by the pink to red or purple flower with proportionately large, 2-lobate lip and conspicuous spur.

Fernandezia Ruiz & Pav.

(D. E. Mora de Retana)

Plant a monopodial epiphyte. Stems erect, creeping or pendulous, concealed by leaf sheaths; pseudobulbs lacking. **Leaves** conduplicate, distichous, articulate, chartaceous, coriaceous, to fleshy, usually elliptic to oblong. **Inflorescence** lateral, short, a few-flowered raceme. **Flowers** showy, red to yellow, orange, or purple, never green, spreading to campanulate. **Sepals** similar, the laterals sometimes partially connate. **Petals** usually larger than the sepals. **Lip** usually simple, often flabellate, sometimes the base parallel with the column and the apex somewhat reflexed, callus present and usually very different between species. **Column** simple, often with broad, dentate wings apically; anther with 2 pollinia with elongate, simple, or furcate stipe, or each with separate stipe; viscidium elongate. **Fruit** a capsule.

A high-elevation genus of perhaps 12 species. Only a single species is known from Central America.

Fernandezia is probably most closely related to *Pachyphyllum*, which has an identical growth habit but much smaller, greenish to whitish flow-

ers. Dressler (1993) notes the similarity of growth habits and pollinia to *Lockhartia* and *Raycadenco* and places both *Fernandezia* and *Pachyphyllum* in the Oncidiinae.

Fernandezia tica Mora-Retana & J. B. García, Brenesia 39–40:163–165. 1993. TYPE: Costa Rica, Heredia, road to Vara Blanca, 2000 m, 27 Oct. 1992, J. T. Atwood & O. Rodríguez 4181 (holotype: USJ). Figure 29D.

Plant epiphytic, monopodial, small, to about 8 cm long. Stems somewhat creeping; roots to 2 mm in diameter. **Leaves** fleshy, green, purplish and keeled beneath, elliptic, ca. 20 mm long, 8 mm wide; forming a prominent sheath at the base ca. 5 mm long; apex acute. **Inflorescence** lateral, short, of 2–3 flowers; ovary with pedicel prominently winged, ca. 13 mm long. **Flowers** fleshy campanulate, red-purple, ca. 8 mm long. **Sepals** subequal, shortly connate at the base, ovate-elliptic, prominently keeled abaxially, 10 mm long, 6 mm wide, acute; dorsal erect; lateral sepals subfalcate. **Petals** elliptic-ovate, 8 mm long, 6 mm wide, the apex recurved. **Lip** simple, elliptic-ovate to somewhat trulliform, 8 mm long, 4 mm wide, somewhat recurved near the middle, forming a cavity at the base; callus on the lower $\frac{2}{3}$ of 2 slender prominent keels ending in a fleshy transverse ridge and bifurcating above. **Column** robust, 7 mm long, with prominent wings above; anther about 1.5 mm in diameter; pollinia 2, elliptic-ovate supported on separate stipes and connected to a prominent elongate viscidium. **Capsule** unknown.

Very poorly known epiphyte at 2000 m, where the type was found growing in strong winds and frequent cloud cover but occasionally exposed to nearly full sun. Flowering in late October but to be expected at other times of the year. Apparently endemic to Costa Rica.

The existence of a fernandezia in Costa Rica has been known for some time, but few specimens had been collected until recently. No other plants were observed growing near the holotype, and the plant is apparently rare.

Goniochilus M. W. Chase

(D. E. Mora de Retana)

REFERENCE—M. W. Chase, Revisions of *Hybochilus* and *Goniochilus* (Orchidaceae). Contr. Univ. Michigan Herb. 16:109–127. 1987.

Plant a caespitose herb epiphytic on twigs. **Pseudobulbs** ovoid to suborbicular, ancipitous; base concealed by 2–3 foliaceous bracts; apex 1-foliate. **Leaves** coriaceous, elliptic-lanceolate, shortly petiolate at the base,

the apex acute. **Inflorescence** lateral at the base of the pseudobulb, a raceme in small plants, paniculate when large. **Flowers** small, colors weakly attractive. **Sepals** dissimilar, carinate, acuminate, the laterals united to $\frac{3}{4}$ their length. **Petals** simple, oblong-elliptic, obtuse. **Lip** 3-lobate, the midlobe emarginate; callus simple. **Column** stout, the base forming a short nectary with the lip; apex with a pair of auricles; anther more or less dorsal; pollinia 2. **Fruit** a capsule.

A monotypic genus differing from closely related *Leochilus* by the conspicuously 3-lobate lip and the column, which is somewhat bent upward. The close apparent relationship with *Leochilus* is supported by evidence from DNA by Chase and Palmer.

Goniochilus leochilinus (Rchb. f.) M. W. Chase, Contr. Univ. Mich. Herb. 16:125. 1987. *Rodriguezia leochilina* Rchb. f., Gard. Chron. 1:970. 1871. TYPE: Costa Rica. *Mesospinidium leochilinum* (Rchb. f.) Schltr., Repert. Spec. Nov. Regni Veg. 19:253. 1923. Figure 30A.

Plant caespitose, epiphytic, somewhat reddish 6–15 cm tall excluding the inflorescence. Rhizome short, roots slender, to 1(1.5) mm in diameter. **Pseudobulbs** 1-foliate, ellipsoid-ovoid to suborbicular, ancipitous, (0.6)1.5–2 cm long, 1.3–1.7 cm wide, covered when young by foliaceous bracts deciduous with age. **Leaves** conduplicate, petiolate, the blade elliptic-lanceolate, carinate abaxially, acute, (2.5)6–14 cm long, (0.6)1.3–2.4 cm wide, the apex asymmetric. **Inflorescences** 1–2, lateral, pendulous, 10–32 cm long including the scape, with few to many flowers; ovary and pedicel 3–6 mm long, subtended by a triangular, acute bract 2–4 mm long. **Flowers** 1 cm high and 5 mm wide; sepals and petals greenish yellow with red-brown spots, the lip white with reddish spots. **Sepals** subequal, strongly concave, carinate, the dorsal ovate, 6–9 mm long, 3–5 mm wide; lateral sepals fused for about $\frac{3}{4}$ their length, each 6–9 mm long, 2–3 mm wide. **Petals** ovate-elliptic, 5–7 mm long, about 3 mm wide. **Lip** 3-lobate, 9–11 mm long, 4 mm wide; lateral lobes semicircular to triangular; midlobe subquadrate, convex, emarginate, the apical $\frac{1}{2}$ forming an obtuse angle with the base; callus on the lower $\frac{3}{4}$ a simple sulcate pad, higher toward the base. **Column** 4–7 mm long; anther globose; pollinia 2, ovoid, with broad triangular stipe and prominent elliptic viscidium. **Cap-sules** ellipsoid, with 3 conspicuous ribs, 1.5–2.5(4.5) cm long including the beak; pedicel 4–5 mm long.

Goniochilus leochilinus grows on twigs and slender branches of trees, often in abandoned coffee, citrus, and guava plantations in premontane and lower montane rain forests at 600–1600 m. Plants are common but little collected. Flowering September to January. Reported from Nicaragua to Panama.

This species can be confused with species of

Leochilus, but the lip is clearly 3-lobate and the column somewhat bent upward, putting the anther in a dorsal position.

Hybochilus Schltr.

(D. E. Mora de Retana)

REFERENCE—M. W. Chase, Revisions of *Hybochilus* and *Goniochilus* (Orchidaceae). Contr. Univ. Michigan Herb. 16:109–127. 1987.

Cespitose epiphytic **herb** of twigs and small branches. **Pseudobulbs** ovoid to suborbicular, subtended by 2–3 foliaceous sheaths; apex 1(2)-foliate. **Leaves** coriaceous, conduplicate, elliptic-lanceolate, the apex unequally 2-lobate. **Inflorescences** 1–2 per shoot, lateral, pendent paniculate. **Flowers** minute, campanulate with rather dull colors. **Sepals** dissimilar, the lateral to $\frac{3}{4}$ united; **petals** free, connivent with the sepals; **lip** simple or obscurely 3-lobate, forming a nectary at the base with the column, subquadrate, retuse; **column** stout, anther terminal.

A monotypic genus endemic to Costa Rica and possibly western Panama.

According to Chase, *Hybochilus* is closely related to both *Leochilus* and to *Goniochilus*. It is easily distinguished from both by the much smaller, campanulate flowers borne in dense panicles.

Hybochilus inconspicuus (Kraenzl.) Schltr., Repert. Spec. Nov. Regni Veg. 16:430. 1920. *Rodriguezia inconspicua* Kraenzl. Bull. Herb. Boissier 3:630. 1895. *Rodriguezia candelariae* Kraenzl. Bot. Jahrb. Syst. 54, Beibl. 117:32. 1916. *Leochilus parviflorus* Standley & L. O. Williams, Ceiba 1:235. 1951.

Plant a caespitose epiphyte 2–11 cm tall. **Pseudobulbs** suborbicular to elliptic-ovoid, rugose when old, 1–2.5 cm long, 0.5–2 cm wide, subtended by 1–2 foliaceous bracts, apex 1-foliate. **Leaves** coriaceous, carinate, elliptic to lanceolate, 1.5–7.5 cm long, 0.6–2.5 cm wide, sometimes shortly petiolate, apex unequally 2-lobate. **Inflorescences** 1–2 per shoot, paniculate, lateral, pendent, many-flowered, 6–20 cm tall; ovary with pedicel 2–4 mm long, subtended by shorter, triangular, acute bracts. **Flowers** minute, inconspicuous, rather closed, sepals greenish with purplish margins, petals whitish with purplish margins, lip white with pale purple spots. **Sepals** dissimilar, the dorsal free, laterals to $\frac{3}{4}$ connate, ovate, 2.5–3 mm long, 1.5–2 mm wide. **Petals** ovate, 2.5–3 mm long, 2 mm wide, obtuse. **Lip** simple or obscurely 3-lobate, 3.5–5 mm long, 1.5–2 mm wide, the apex emarginate; callus an elongate, 2-lobate pad. **Column** stout, 0.5–1 mm long, about 1 mm in diameter, the apex with a pair of extrorse stigmatic arms, forming a

nectary at the base with the lip. **Capsules** 0.8–1(1.5) mm long including pedicel and beak.

Rather common twig epiphytes in evergreen and often disturbed cloud forests at 950–1500 m; often seen in coffee plantations. Flowering (January) February to May (June). Costa Rica, especially in the Central Valley; also reported from Panama.

This species is easily recognized by the minute flowers on plants resembling *Leochilus*. The above synonymy and floral measurements are taken from Chase's revision.

Key to the Species of *Ionopsis*

- 1a. Leaves terete *I. satyrioides*
- 1b. Leaves flat *I. utricularioides*

Ionopsis satyrioides (Sw.) Rchb. f., Ann. Bot. Syst. 6:683. 1863. *Epidendrum satyrioides* Sw., Prod. 123. 1788. TYPE: Hispaniola. *Ionopsis costaricensis* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:62. 1923. TYPE: Costa Rica, Wercklé 25 (not seen).

Plant a caespitose epiphyte of twigs and smaller branches; roots fibrous, to 0.5 mm in diameter. **Pseudobulb** nearly obsolete and often hidden by subtending leaves. **Leaves** 3–6, terete, acute, 2.5–13 cm long, to 3–4 mm in diameter. **Inflorescence** a lateral successively flowered raceme 6–19 cm long including the scape; ovary with pedicel 8–10 mm long, subtended by much shorter subulate bracts. **Flowers** white or with fine purple lines, with yellow callus. **Sepals** somewhat campanulate, shortly connate at the base and not widely spreading, lanceolate-elliptic, acute, 5–6 mm long, 1.5–2 mm wide, the lateral forming a short mentum. **Petals** oblanceolate to elliptic, obtuse, recurved, 5.5–6.5 mm long, 1.5–2 mm wide. **Lip** cuneate, lightly emarginate, 7.5–8 mm long, 2.5–3, with a pair of mammillate calli at the base. **Column** stout, 1.5–2 mm long. **Capsule** obovoid, about 1 cm long.

Epiphytic and common in disturbed moist forest at 0–750 m. Flowering August to October. Reported throughout Mesoamerica, West Indies, and South America. *Ionopsis satyrioides* is easily recognized by the terete leaves and small, whitish flowers with large, emarginate lip. There is some suggestion that there may be more than one species here accepted as one.

***Ionopsis* H. B. K.**
(D. E. Mora de Retana)

Epiphytic **herb** usually on twigs; rhizomes short to much elongate, with at most rudimentary **pseudobulbs**. **Leaves** lateral, rarely at the pseudobulb apex, terete or flat, conduplicate and somewhat fleshy. **Inflorescence** lateral, slender, erect or arcuate, a simple raceme or panicle, with elongate scape. **Flowers** usually small. **Sepals** and **petals** subequal, the lateral sepals connate at the base producing a short sac; **lip** clawed and adnate to the column base, much exceeding the tepals, 2-lobate. **Column** footless, lacking wings; pollinia 2, waxy, supported on viscidium and elongate stipe. **Fruit** a capsule.

A mostly lowland genus of three species ranging throughout the neotropics.

Ionopsis utricularioides (Sw.) Lindl., Coll. Bot. t. 39A. 1821. *Epidendrum utricularioides* Sw., Prodr. 122. 1788. Figure 30B.

Plant an epiphyte, usually of twigs and smaller branches, usually with only 1–2 shoots, to 15 cm high; roots fibrous, 0.5–1 mm in diameter. **Pseudobulbs** short, 6–10 mm tall, 4–5 mm wide, concealed by the subtending 2–4 foliaceous sheaths. **Leaves** distichous, somewhat fleshy, with conspicuous raised veins adaxially, variable in shape from elliptic to oblong or oblanceolate, acute, 4–15 cm long, 0.6–2 cm wide. **Inflorescence** a somewhat successively flowered panicle borne laterally near the pseudobulb base, to 50 cm high including the peduncle; ovary with pedicel 5–10 mm long. **Flowers** white or pink, veined with magenta. **Sepals** dissimilar; dorsal ovate, acute to obtuse, 3.5–4.5 mm long, 1.8–2.3 mm wide; lateral sepals shortly connate, acute, 4.5–5.5 mm long, 1.4–2 mm wide, forming a short mentum at the base. **Petals** ovate, 3.5–5 mm long, 1.8–2.5 mm wide. **Lip** shortly clawed at the base, flabellate-obovate and deeply emarginate, 10–12 mm long, 7–10 mm wide, with 3 purple lines at the base, and a pair of white calli. **Column** cylindric, stout, 2 mm long; anther with cucullate, somewhat beaked anther, pollinia 2 supported on an elongate stipe and elongate viscidium. **Capsules** ellipsoid, without beak, about 2.5 cm long; pedicel 7–8 mm long.

Epiphytic on twigs and smaller branches of usually disturbed evergreen forests, often seen in coffee and guava at 0–880 m. Flowering mostly January to May (August). Widespread and locally common throughout the wetter lowland neotropics.

Ionopsis utricularioides is easily recognized by

the flat, somewhat fleshy leaves, the pseudobulb, which usually lacks an apical leaf, and the panicles of the pinkish flowers with a large, emarginate lip.

Leochilus Knowles & Westcott

(D. E. Mora de Retana)

REFERENCES—M. W. Chase, A Monograph of *Leochilus* (Orchidaceae). Systematic Botany Monographs 14. 97 pp. 1986. M. W. Chase, Pollination ecology of two sympatric, synchronously flowering species of *Leochilus* in Costa Rica. Lindleyana 1:141–147. 1986.

Small caespitose **herb**, epiphytic, often on twigs and smaller branches. **Pseudobulbs** elliptic-ovoid to subor-

bicular, compressed, 1–2-foliate, subtended by 2–3 leaves, the apex 1–2-foliate. **Leaves** coriaceous, conduplicate, elliptic to lanceolate, acute to obtuse. **Inflorescence** an erect or pendent lateral raceme or panicle with slender peduncles and 1–many successively borne flowers. **Flowers** small, colors generally dull. **Sepals** spreading, the laterals free or variously connate, adnate to lip base. **Petals** similar to the sepals, free. **Lip** adnate to column base forming a nectary, longer than the sepals and petals, simple or lightly 2-lobate, with a fleshy callus near the base. **Column** footless, short, with arms on each side at about the middle; pollinia 2, waxy. **Fruit** a capsule.

A Neotropical genus of about nine species centered mainly in Mesoamerica and the Caribbean; also in northern and western South America. Three species are known in Costa Rica.

The relationships of *Leochilus* are clearly with *Goniochilus* and *Hybochilus*, and possibly with other genera of mostly twig epiphytes. For synonymies see the revision of *Leochilus* by Chase.

Key to the species of *Leochilus* (including *Hybochilus* and *Goniochilus*)

- 1a. Sepals ≥ 3.5 mm long 2
- 2a. Lip simple, whitish to yellow often with dull spots 3
- 3a. Plants clearly reddish *Leochilus labiatus*
- 3b. Plants clearly green 4
- 4a. Pseudobulbs prominent, ovoid, usually > 2 cm long, low-elevation plants
..... *Leochilus scriptus*
- 4b. Pseudobulbs mostly hidden by foliaceous bracts, < 1.9 cm tall, plants mid to high elevation *Leochilus tricuspidatus*
- 2b. Lip 3-lobate, white with dark spots *Goniochilus leochilinus*
- 1b. Sepals ≤ 3.25 mm long *Hybochilus inconspicuus*

***Leochilus labiatus* (Sw.) Kuntze, Revis. gen. pl. 2:656. 1891. *Epidendrum labiatum* Sw., Nov. gen. & sp. pl., Prodr. 124. 1788. Figure 30C.**

Plant a small caespitose twig epiphyte 2–5 cm tall excluding inflorescence; roots long, to about 1 mm in diameter. **Pseudobulbs** compressed, orbicular to ovate, 1–1.8 cm tall, with 1–2 leaves at the base, apex 1-foliate. **Leaves** coriaceous, elliptic to lanceolate, acute, 2–4.5 cm long and 1–1.5 cm wide. **Inflorescence** a raceme or panicle with 1–2 branches, lateral at the pseudobulb base, successively flowered, 2–12 cm long including the peduncle; ovary with pedicel about 6–9 mm long. **Flowers** with sepals and petals yellowish green marked with red-brown and with a yellow lip marked with red-brown. **Sepals** dissimilar, the dorsal sepal ovate, acute, cucullate, 5–6.5 mm long, 2.5 mm wide; the lateral sepals free to $\frac{1}{2}$ united, about 5–6 mm long. **Petals** ovate-elliptic, about 4–5 mm long. **Lip** obovate, emarginate, about 7–8 mm long and 3–4 mm wide, provided with a shallow basal nectary and a central fleshy callus most prominent below the middle. **Column** about 2.5 mm

long, with a pair of oblong arms at about the middle; anther with 2 pollinia supported on an elongate stipe and viscidium. **Capsules** ellipsoid, weakly 3-carinate, 2.5 cm long including the prominent beak; pedicel 8–10 mm long.

Common twig epiphytes, of evergreen forests at 50–2000 m. It is often weedy in coffee plantations, citrus groves, and guava. Flowering mostly October to April. For distribution Chase includes the West Indies, Mesoamerica, and northern South America.

Leochilus labiatus is easily distinguished from the other species by the reddish plants, suborbicular pseudobulbs, and greenish yellow flowers with red-brown markings. Chase did not encounter specimens below 500 m in Costa Rica, but a specimen at SEL collected at less than 100 m (*Atwood* 85–72) appears to be this species.

Leochilus scriptus (Scheidw.) Rchb. f., *Xenia* Orchid. 1:15. 1854. *Cryptosanus scriptus* Scheidweiler, Allg. Gartenzeitung 11:101. 1843.

Plant a caespitose epiphyte 8–15 cm high; rhizomes short, roots to 1.5 mm in diameter. **Pseudobulbs** ovoid, not strongly compressed, grooved, 2–5 cm long, 1–2.5 cm wide, subtended by 1–2 foliaceous sheaths, apex 1-foliate. **Leaves** somewhat petiolate, the blade elliptic-lanceolate, 4–12 cm long, 1–3 cm wide, apex acute. **Inflorescences** 1–2, 4–15(29) cm long, each a raceme or panicle; ovary with pedicel about 1 cm long, subtended by shorter, triangular bracts. **Flowers** fragrant, 1–6, tepals greenish yellow with reddish spots, lip yellow to yellowish green with red to rose spots. **Sepals** oblong-lanceolate, dissimilar, acute, 7–12 mm long, 3–5 mm wide; dorsal free; lateral sepals to $\frac{1}{2}$ connate. **Petals** ovate, acute, 7–10(15) mm long, 5–7 mm wide. **Lip** obovate, emarginate, 6–12(14) mm long, 5–9 mm wide, forming a rounded nectary at the base with the column. **Column** 6–8 mm long, pollinia 2 on an elongate stipe with viscidium. **Capsules** 3–4 cm long including the long beak; pedicel 1–1.2 cm long.

Leochilus scriptus grows in moist to semideciduous forests at 0–600(1100) m. Flowering in Costa Rica mostly December to April. Reported from Mesoamerica to coastal tropical South America, Cuba, and the Dominican Republic.

This species is easily distinguished from others principally by its lower-elevation distribution and in its large pseudobulbs. The flowers otherwise resemble those of the other species.

The above measurements incorporate those published by Chase in his revision of *Leochilus*.

Leochilus tricuspidatus (Rchb. f.) Kraenzl., Pflanzenr. IV. 50(Heft 80):297. 1922. *Oncidium tricuspidatum* Rchb. f., Beitr. Orch.-K.C.Amer. 72. 1866. Figure 30D.

Plant epiphytic, caespitose, 8–12 cm high excluding inflorescence. Rhizome short; roots 1–1.5 mm in diameter. **Pseudobulbs** ovate to lanceolate, 1(2)-foliate, compressed, 1–1.8 cm long, 4–6 mm wide. **Leaves** subcoriaceous, elliptic-lanceolate, apically asymmetric, 5–9.5 cm long, 0.9–2 cm wide. **Inflorescences** paniculate, 1–2 from the base of the pseudobulb, 8–35 cm high, with 5–15 flowers, lightly fractiflex, the scapes covered by triangular, papery bracts; ovary with pedicel 5–11 mm long. **Flowers** opening successively, greenish yellow with brown spots, the lateral sepals with the spots coalescing into a central line, 1.4–1.6 cm long and 9–11

mm broad. **Sepals** free, subequal; dorsal sepal elliptic-lanceolate, concave, obtuse; lateral sepals elliptic-lanceolate, subfalcate, acute, carinate, 5–8 mm long, 3–4 mm wide. **Petals** free, elliptic, obtuse, concave, 4–7 mm long, 3–4 mm wide. **Lip** simple, oblanceolate, obtuse, pubescent, with a small nectary at the base, 5–12 mm long, 2.5–5 mm wide; blade with 2 erect projections at the base and an erect callus with numerous small hairs, the apex emarginate. **Column** semiterete, 4–8 mm long, the apex denticulate, with 2 fleshy auricles beside the stigma; pollinia 2, with elongate stipe and viscidium. **Capsule** ellipsoid, strongly 3-carinate, 2–3 cm long, pedicel 1–1.2 cm long.

This species is a twig epiphyte of evergreen forests at 1200–2000 m. Flowering mostly February to June and sporadically to October. Endemic to Costa Rica and adjacent Chiriquí, Panama.

Leochilus tricuspidatus is easily distinguished by the small pseudobulbs hidden by subtending foliaceous bracts.

Lockhartia Hook.

(D. E. Mora de Retana)

REFERENCE—M. W. Chase, A reappraisal of the Oncidioid orchids. Syst. Bot. 11:477–491. 1986.

Epiphytic, caespitose, psygmoid **herb**, stems unbranched above. **Pseudobulbs** none. **Leaves** congested and sheathing the stem, imbricate, remaining conduplicate, inarticulate, usually triangular in profile. **Inflorescences** 1–several racemes, lateral, of 1–several flowers. **Flowers** usually attractive, usually yellow with red marking or white, complex, especially the callus of the lip. **Sepals** simple, ovate, free, concave, reflexed. **Petals** simple, ovate. **Lip** simple to complexly lobed, the callus often complex. **Column** short, usually winged, lacking a tabula infrastigmatica; pollinia 2, usually obovate to clavate, with stipe and small viscidium. **Fruit** a capsule.

An odd genus of 20–25 species native from Mexico to South America but noticeably absent from the Antilles. Six species are known from Costa Rica.

The relationships of *Lockhartia* are unclear, but they probably belong within the Oncidiinae. The flowers superficially resemble those of *Oncidium* but lack the tabula infrastigmatica. Plant habit is similar to that of *Psymorchis* Dodson & Dressler but has a longer stem.

Key to the Species of *Lockhartia*

- 1a. Lateral lobes present at the base of the lip 2
 - 2a. Flowers < 1 cm tall *L. micrantha*
- 2b. Flowers > 1 cm tall 3
 - 3a. Lip apex less than twice as broad as base of midlobe; floral bracts 6–10 mm wide
..... *L. amoena*
 - 3b. Lip apex at least twice as broad as base of midlobe; floral bracts < 6 mm wide
..... *L. oerstedii*
- 1b. Lateral lobes absent at the base of the lip, lip entire, 2-lobate or with lateral lobes near the middle 4
 - 4a. Flowers white, lip suborbicular, callus orange, leaves slender and flexible *L. hercodonta*
 - 4b. Flowers yellow, lip longer than wide; leaves stiff 5
 - 5a. Flowers at least 1.2 cm tall, inflorescence compact with inconspicuous branches
..... *L. pittieri*
 - 5b. Flowers ≤ 1 cm tall; inflorescence spreading and diffuse, the branches conspicuous
..... *L. acuta*

Lockhartia acuta (Lindl.) Rchb. f., Bot. Zeitung (Berlin) 10:767. 1852. *Fernandezia acuta* Lindl., Edwards's Bot. Reg. 21: t. 1806. 1836. TYPE: Trinidad. *Lockhartia pallida* Rchb. f., Bonplandia 2:14. 1854. TYPE: Venezuela, Carabobo, Wagoner (w, photo). Figure 32A.

Plant epiphytic, caespitose, to 40 cm; roots slender, 0.5–1 mm in diameter. Stems arcuate or pendulous, laterally flattened, leafy, 25–40 cm long. **Leaves** distichous, densely imbricate, somewhat fleshy, triangular in profile, acute, 2–3.5 cm long, 3–9 mm deep. **Inflorescence** terminal or lateral near the apex, diffusely branched, with few flowers opening in succession; ovary and pedicel ca. 9 mm long, subtended by cordate bracts 1–2 mm long and 1–2 mm wide. **Flowers** cream-white, small for the genus, 5–9 mm tall, 7–8 mm wide. **Sepals** similar, rounded or obtuse, free, concave, 2–3 mm long, 2–3 mm wide. **Petals** similar to the sepals in form and size. **Lip** simple to obscurely 3-lobate, subquadrate, with reddish brown marks on the basal half, 5–6 mm long, 3–4 mm wide, the apex retuse and with somewhat irregular lateral margins; lower ½ with a pale, papillose callus, the apex with 2 rounded projections. **Column** white with reddish brown spots at the base, with rounded wings, the margins smooth, 1–2 mm high, 2–3 mm wide; anther papillose; pollinia 2, pyriform with relatively large stipe and viscidium.

Epiphytic in seasonally moist forests of the Pacific drainage at 50–600 m. Flowering December to March. Known from Costa Rica to Colombia, Venezuela, Trinidad, and Tobago.

Lockhartia acuta is similar to *L. micrantha* Rchb. f. but may be distinguished by the much larger, usually pendulous stems and by the more diffuse, branching inflorescence. Costa Rican examples lack the extreme acute lateral lobes of the lip found in the type from Trinidad.

Lockhartia amoena Endres & Rchb. f., Gard. Chron. 666. 1872. TYPE: Costa Rica, Endres (w, photo). *Lockhartia costaricensis* Schltr., Repert. Spec. Nov. Regni Veg. 3:81–82. 1906. TYPE: Costa Rica, Los Palmares, Pittier 10592 (AMES). *Lockhartia dipleura* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:69. 1923. TYPE: Costa Rica, Wercklé 102. *Lockhartia grandibractea* Kraenzl., Pflanzenr. IV. 50 (Heft 83):15. 1923. TYPE: Costa Rica, Endres (w, photo). *Lockhartia triangulabia* Ames & C. Schweinf., Sched. Orch. 8:80–81. 1924. TYPE: Panama, Province of Chiriquí, Powell 362a (AMES). *Lockhartia amoena* var. *triangulabia* (Ames & C. Schweinf.) C. Schweinf. & P. H. Allen, Bot. Mus. Leaflet 13:150. 1948. Figure 31A.

Plant epiphytic, caespitose, to 40 cm tall. Roots slender, 0.5–1 mm in diameter. Stems erect, pendulous when large, flattened. **Leaves** distichous, somewhat fleshy, triangular in profile, acute, 1.3–3.5 cm long, 5–10 mm deep. **Inflorescence** branched, terminal or lateral near the apex, few- to many-flowered; ovary with pedicel 15 mm long, subtended by cordate, suborbicular bracts 4–10 mm long and 6–10 mm wide. **Flowers** deep yellow with reddish brown spots, of medium size for the genus, 1.3–1.9 cm long, 1.6–1.7 cm wide. **Sepals** similar, free, ovate, apiculate, 5–7 mm long, 4–6 mm wide, the dorsal lightly reflexed, the lateral strongly reflexed. **Petals** similar, free, somewhat larger than the sepals, oblong to elliptic, with undulate margins, 7–8 mm long, 4–5 mm wide, obtuse. **Lip** 3-lobate, 5–9 mm long, 6–8 mm wide; the lateral lobes linear, obtuse, incurved, 5–7 mm long, 1–3 mm wide; midlobe subquadrate, emarginate, with the base more than ½ the width of the apex; disk with callus of papillae from the base to ca. ¾ the lip, emarginate in front. **column** broadly winged, 2–3 mm high,

5–6 mm wide, the margins denticulate; anther papillose; pollinia 2, pyriform; stipe and viscidium small.

Lockhartia amoena grows on larger branches and tree trunks in premontane forests at 800–1400 m. Flowering throughout the year. Reported from Mexico to Colombia.

Lockhartia amoena, as here interpreted, is a most variable species, especially in the size of the inflorescences, number of flowers, and midlobe of the lip. *Lockhartia dipleura* Schltr. is based on a plant with a nearly entire, not emarginate, midlobe, but we find intermediates between plants with entire and plants with deeply emarginate lips, and both extreme forms have the same linear lateral lobes and similar calli.

Lockhartia hercodonta Rchb. f. ex Kraenzl., Pflanzenr. IV. 50 (Heft 83):8, t. 2A. 1923. TYPE: Costa Rica, Endres (w, photo). Figure 31B.

Plant caespitose, epiphytic, 10–45 cm high. Rhizome short, with slender roots < 1 mm in diameter. Stems erect or pendulous, compressed, foliaceous. **Leaves** triangular in profile, thin and flexible, imbricate, 2.8–4.3 cm long, lateral width 5–10 mm deep; apex usually incurved, acute to somewhat acuminate. **Inflorescence** apparently terminal or subterminal, usually branched, successively flowered; ovary and pedicel 5–6 mm long, subtended by variable, ovate-lanceolate, acuminate bracts 5–7 mm long. **Flowers** small, 8–10 mm in diameter, white, the lip with orange callus. **Sepals** concave, ovate, acute, 3–4 mm long, 2–3 mm wide. **Petals** lightly rounded, concave, 4–5 mm long, 3–4 mm wide. **Lip** simple, suborbicular, 4–5 mm long, 6–7 mm wide; with an elevated, cuplike, papillose, apically bidentate callus. **Column** short, broad, 2–3 mm long, with crenulate wings on the upper ½; pollinia 2 with stipe and minute viscidium. **Capsule** globose to ellipsoid, 8 mm long, with pedicel ca. 5 cm long.

This species grows in premontane and lower montane rain forests at 900–2000 m, usually in deep shade. Flowering August to March and sporadically in June and July. Reported from Guatemala to Panama and Colombia.

Lockhartia hercodonta is easily distinguished from others, especially the cream-white-flowered *L. acuta* (Lindl.) Rchb. f., by the soft, thin leaves, suborbicular lip, and orange callus. Vegetatively it is similar to *L. pittieri* Schltr., a low-elevation species with yellow flowers.

Lockhartia micrantha Rchb. f., Bot. Zeitung (Berlin) 10:768. 1852. TYPE: Panama(?), Veragua, Hinds (w, photo). *Lockhartia chiriquensis*

Schltr., Repert. Spec. Nov. Regni Veg. 12:215. 1913. TYPE: Panama, Chiriquí near San Felix, Pittier (AMES, drawing). *Lockhartia lankesteri* Ames, Sched. Orch. 5:36. 1923. TYPE: Costa Rica, San Carlos, Lankester 448 (holotype: AMES). Figure 31C.

Plant epiphytic, caespitose, compact, 12–30 cm high. Roots slender, 0.5–1 mm in diameter. Stems erect or pendulous, laterally flattened, densely foliaceous. **Leaves** distichous, densely imbricate, triangular in profile, somewhat fleshy, acute, 0.8–2 cm long, 5–8 mm wide. **Inflorescence** short, terminal or lateral near the apex, of few flowers; ovary with pedicel 8–9 mm long, subtended by cordate, acuminate bracts, ca. 6 mm long. **Flowers** small for the genus, 7–9 mm long and about as wide, clear or pale yellow, column pale yellow with small reddish brown spots at base, callus with small, brown spots. **Sepals** concave, similar, ovate, apiculate, free, 5–6 mm long, 4–5 mm wide. **Petals** elliptic, 5–6 mm long, 2–3 mm wide; margins lightly undulate. **Lip** 3-lobate, 5–6 mm long, 6–7 mm wide; lateral lobes linear, ascending, obtuse; midlobe, cuneate, emarginate with a small notch on each side; callus suborbicular, verrucose, broad at the base, narrow at the apex. **Column** 2 mm long with broad wings; anther cucullate, papillose; pollinia 2, pyriform, with relatively large stipe. **Capsules** obovoid to ellipsoid, 6–8 mm long, pedicel ca. 1–1.2 cm long.

This species generally grows in humid open forests at 10–900 m in bright light. Flowering November to April. Broadly distributed from Nicaragua to Panama; also reported from northwestern South America.

Lockhartia micrantha is characterized by the small, pale yellow flowers and linear lobes at the base of the lip.

Lockhartia oerstedii Rchb. f., Bot. Zeitung (Berlin) 10:767–768. 1852. TYPE: Costa Rica, Barba, Oersted s.n. (K, photo seen). *L. verrucosa* Lindl. ex Rchb. f., Hamburger Garten-Blumenzeitung 15:53–54. 1859. TYPE: *Stange?* (K, photo). *Lockhartia lamellosa* Rchb. f. Hamburger Garten-Blumenzeitung 21:300. 1865. TYPE: Mexico, *Stange*. *Fernandezia robusta* Bateman, Bot. Mag. t. 5592. 1866. TYPE: Guatemala, *Skinner s.n.* *Lockhartia robusta* (Bateman) Schltr., Repert. Spec. Nov. Regni Veg. 3: 82. 1906. Figure 31D.

Plant epiphytic, caespitose, sometimes densely so. Roots slender, 0.5–1 mm in diameter. Stems erect or arcuate, (12)25–40 cm long. **Leaves** distichous, imbricate, triangular in profile, somewhat fleshy, acute, about 1–3 cm long, 4–8 mm deep. **Inflorescence** of few successively borne flowers, terminal or lateral near the stem apex; ovary with pedicel 1–1.5 cm long, subtended by

cordate bracts about 5 mm long, 4 mm wide. **Flowers** bright yellow with reddish brown spots, rather large for the genus, 2–2.5 cm high and 1–1.5 cm wide. **Sepals** similar, free, elliptic, obtuse, reflexed, 5–9 mm long, 6–7 mm wide. **Petals** ovate, larger than the sepals, the margins undulate, 8–11 mm long, 5–7 mm wide. **Lip** 3-lobate, the margins undulate, 1.3–1.6 cm long, 1.2–1.5 cm wide; basal lateral lobes spatulate, obtuse, incurved, 7–9 mm long, 2–4 mm wide; midlobe 2-lobate, with narrow base less than $\frac{1}{2}$ the width of the apex, the disk with a complex callus centrally of 7 rows of teeth, the central row with smaller teeth. **Column** 2–3 mm long, 4–5 mm wide, with very broad wings with dentate margins; anther papillose; pollinia 2, pyriform, with minute stipe and viscidium. **Capsules** obovoid, ca. 1.2–1.5 cm long, pedicel ca. 1.4 cm long.

Lockhartia oerstedii is a midcanopy epiphyte of evergreen premontane and lower montane forests at 1100–1800 m. Flowering December to May, August to September, and perhaps throughout the year. Reported from Mexico to Panama and Colombia.

This species has among the largest and most attractive flowers of the genus. It is distinguished from the similar *L. amoena* Endr. & Rchb. f. by the more slender shoots, the more compact inflorescences, and the more complex callus with 7 rows of teeth.

Lockhartia pittieri Schltr., Repert. Spec. Nov. Regni Veg. 12:216. 1913. TYPE: Panama, *Pittier* (drawing of type: AMES). *Lockhartia variabilis* Ames & C. Schweinf., Sched. Orch. 8: 81–82. 1925. TYPE: Panama, near Frijoles, *Powell* 355 (holotype: AMES). *Lockhartia integra* Ames & C. Schweinf., Sched. Orch. 10: 108. 1930. TYPE: Costa Rica, Guanacaste, El Silencio, near Tilarán, *Standley & Valerio* 44675 (holotype: AMES). Figure 32B.

Plant an erect or pendent epiphyte 15–20 cm tall; rhizome short, roots < 1 mm in diameter. **Leaves** densely imbricate, triangular in profile, 2–3.5 cm long, 2.5–6 cm wide, acute. **Inflorescence** short, 1–apparently few flowers, lateral on the upper $\frac{1}{2}$ of the stem; ovary and pedicel 9–10 mm long, subtended by an ovate, cordate, acuminate bract 3.5 mm long and 2.5 mm wide. **Flowers** yellow with orange-brown callus, ca. 1.4 cm high, 1 cm wide. **Sepals** concave, elliptic-ovate, reflexed at the base, 5–6 mm long, 4–5 mm wide; apex dorsally carinate, acute. **Petals** ovate-lanceolate, dorsally carinate, 6–8 mm long, 5–6 mm wide, acute. **Lip** convex, generally obovate to subquadrate, 8–9 mm long, 5–6 mm wide; apex 2-lobate; callus ovate, concave, margin lightly pilose, with 3 fleshy keels at the base, the central larger than the lateral. **Column** stout with broad, denticulate wings for the entire length, 3 mm long; pollinia 2 with caudicles, obovoid, with stipe and small viscidium. **Cap-**

sule suborbicular to ellipsoid, 8–10 mm long, pedicel ca. 1 cm long.

Epiphytic in midcanopies in humid tropical forests at 30–800 m. Flowering November to May. Belize to Panama; also reported from Ecuador.

Plant is similar to that of *L. hercodonta* Rchb. f. ex Kraenzl. but lives at lower elevations, and the flowers are larger and yellow.

Lockhartia pittieri Schltr. is based on a type from Panama with a 4-lobate lip, a feature that may be an artifact. For the moment we are following others in accepting this as the oldest available synonym for *L. integra* Ames & C. Schweinf., which is based on Costa Rican material with a 2-lobate lip.

Macroclinium Barb. Rodr.

(F. Pupulin and D. E. Mora de Retana)

REFERENCE—F. Pupulin, New and critical *Macroclinium* (Orchidaceae) from Central America. *Lindleyana* 11:135–140. 1996.

Plant perennial, epiphytic, caespitose, sympodial with pseudobulbs or submonopodial without. **Pseudobulbs** when present more or less inconspicuous, ovoid or rounded, compressed, apically 1-foliate, concealed by leaf sheaths. **Leaves** usually 3–7 (34) per shoot, conduplicate, laterally flattened, the basal ones articulate with imbricate sheaths often provided with hyaline margins; blades linear-lanceolate to subfalcate-lanceolate. **Inflorescence** lateral, subumbellate or elongate with flowers well separated, often branched, 2–many-flowered, often successive, arising from the axils of the upper leaf sheaths. **Flowers** small, hyaline. **Sepals** free or shortly connate, **petals** similar to the sepals, spreading. **Lip** free or adnate to the column base, with or without calli or lateral lobules near the base. **Column** slender, linear-clavate, sometimes abruptly and dorsally reflexed at the apex, sometimes slightly adnate to the lip, foot lacking; pollinia 2, strongly compressed, supported on a slender, triangular stipe. **Fruit** a capsule.

A genus of about 38 species distributed from southern Mexico to Brazil, generally as twig epiphytes on the upper or the outer portion of the canopy. Fifteen species are reported from Central America, 10 of which occur in Costa Rica. Phylogenetically, *Macroclinium* has several derived character states within the *Rodriguezia* clade (Chase & Palmer, 1992), a group of orchids specialized to occupy the more xeric habitat of twigs in Neotropical canopies, including *Ionopsis*, *Tri-zeuxis*, *Notylia*, *Warmingia*, and *Macradenia*.

Key to the Species of *Macroclinium*

- 1a. Inflorescence a raceme with flowers well separated 2
 - 2a. Callus of the lip papillose-hirsute *M. robustum*
 - 2b. Callus of the lip glabrous. 3
 - 3a. Lateral sepals free; lamina of the lip cordate-sagittate *M. ramonense*
 - 3b. Lateral sepals connate; lamina of the lip ovate *M. confertum*
- 1b. Inflorescence subumbellate, the flowers close together 4
 - 4a. Lip without lateral, retrorse auricles *M. lineare*
 - 4b. Lip with two lateral, retrorse auricles at base 5
 - 5a. Lip ecallose *M. doderoi*
 - 5b. Lip with a basal callus between auricles 6
 - 6a. Column with abruptly and dorsally reflexed apex 7
 - 7a. Lip free from the column; callus of the lip with transverse hairs *M. glicensteinii*
 - 7b. Lip adnate to the base of the column; callus glabrous 8
 - 8a. Lamina of lip cordate, with a single callus between auricles *M. allenorum*
 - 8b. Lamina of the lip hastate, with 2 membranous calli between auricles *M. generalense*
 - 6b. Column without such a reflexed apex 9
 - 9a. Pseudobulbs > 1 cm long *M. cordesii*
 - 9b. Pseudobulbs < 1 cm long *M. paniculatum*

Macroclinium allenorum Dressler & Pupulin, Lindleyana 11:34–36. 1996. TYPE: Costa Rica, Puntarenas, vicinity of Palmar Norte, Río Ter-raba, *Allen 5244* (holotype: US; isotypes: F, SEL).

Plant epiphytic, caespitose, small. Rhizome short, roots filiform. **Pseudobulbs** inconspicuous, compressed-ellipsoid, 4–8 mm long, closely invested by 3–5 conduplicate, leaf-bearing sheaths, apex 1-foliate. **Leaves** conduplicate, laterally flattened, lanceolate to narrowly elliptic-lanceolate, 12–25 mm long, 2.8–5.8 mm wide; the basal leaves articulate to the broad sheaths with hyaline margins. **Inflorescence** a simple subumbellate raceme, becoming paniculate, 1.5–11 cm long, provided with 2–3 conspicuous, concave, acute bracts 8–11 mm long, 5 mm wide; ovary with pedicel subclavate, subtended by a lanceolate floral bract, shorter than the pedicellate ovary. **Flowers** small; sepals white, hyaline; petals white, spotted with rose-red; lip lavender. **Sepals** dissimilar; dorsal lanceolate-elliptic, acuminate, cucullate, 5.5–7 mm long, 0.8–1.3 mm wide; lateral sepals oblong-lanceolate, acuminate, free, dorsally carinate, 6–8 mm long, 0.8–1 mm wide. **Petals** obliquely lanceolate, acuminate, 4.7–6 mm long, 0.8 mm wide. **Lip** with a linear claw ca. 2 mm long, adnate to base of column for more than ½ of claw; blade 5–5.5 mm long, triangular-cordate, with serrulate margins, acuminate to mucronate, the midlobe unguiculate, the isthmus subequal to basal claw with 2 short retrorse auricles near the base, with thickened, glabrous callus between auricles. **Column** slender, ca. 5 mm long, abruptly dorsally reflexed at apex; anther triangular, cucullate; pollinia 2, compressed, on a long, triangular stipe; viscidium elliptic.

Epiphytic in moist premontane forests at 0–400

m. Flowering December to May. Costa Rica; supposedly endemic in the region of Palmar Norte to Golfito.

Macroclinium allenorum may be distinguished from *M. glicensteinii* J. T. Atwood and *M. generalense* Pupulin by the lip with long claw partially adnate to the base of the column and by the cordate midlobe with serrulate margins. In addition, both the transverse hairs on the callus of *M. glicensteinii* and the two membranous calli of *M. generalense* are absent in *M. allenorum*.

Macroclinium confertum Pupulin, Lindleyana 11:138–140. 1996. TYPE: Costa Rica, San José, Dota, San Marcos, road to San Joaquín, *Pupulin 204* (holotype: US). Figure 32C.

Plant epiphytic, small, caespitose, sympodial. Rhizome short, roots filiform. **Pseudobulbs** inconspicuous, ovate, somewhat compressed, 6–7 mm long, 4.5–5 mm wide, covered at the base by 3–7 leaf-bearing sheaths, apex 1-foliate. **Leaves** conduplicate, laterally flattened, linear-lanceolate to subfalcate-lanceolate, to 5.5 cm long, 6 mm wide, acute; the basal leaves articulate to sheaths with hyaline margins. **Inflorescence** a pendent raceme with many flowers (11–13), to 8 cm long, provided at the base with 2–3 lanceolate, subulate bracts ca. 4 mm long; ovary with pedicel subclavate, to 7 mm long, subtended by a lanceolate, acuminate, floral bract ca. 3 mm long, 1.5 mm wide. **Flowers** rather large for the plant; sepals white, hyaline; petals pale rose to lavender spotted with purple; lip lavender. **Sepals** dissimilar; dorsal concave, linear-lanceolate, acuminate, to 16 mm long,

2.2 mm wide; lateral sepals shortly connate for ca. 1 mm, somewhat concave toward the base, narrowly linear-lanceolate, ca. 1.6 cm long, 1.3 mm wide, acuminate to setaceous. **Petals** obliquely lanceolate, to 1.2 cm long, 1.9 mm wide, acuminate to setaceous. **Lip** with linear claw 1 mm long free from the column; blade 9.7–10.1 mm long, 2 mm wide at the middle, the base narrowly cuneate and with a pair of triangular, deflexed, and somewhat twisted auricles; apex setaceous; margins crisped; callus between auricles glabrous, obtrullate. **Column** slender, clavate, ca. 4 mm long, with cuneate, acute apex; anther cucullate; pollinia 2, strongly compressed; stipe hyaline, elongate, triangular; viscidium elliptic, brown.

Epiphytic on lower twigs in wet premontane forests at 1300–1500 m. Flowering at least May to June. Endemic to valleys of the Dota region in central Costa Rica.

The shortly connate lateral sepals, the blade of the lip with ovate central portion, and the obtrullate, glabrous callus easily distinguish *M. conferum* from its closest allied species, *M. ramonense* (Schltr.) Dodson and *M. robustum* Pupulin & Mora-Retana.

Macroclinium cordesii (L. O. Williams) Dodson,

Icon Pl. Trop. 10: t. 938. 1984. *Notylia cordesii* L. O. Williams, Ann. Missouri Bot. Gard. 26: 286. 1939. TYPE: Panama, Bocas del Toro, Mosquito Hill, *Cordes ex Woodson, Allen, & Seibert* 1932 (MO, not seen). Figure 33A.

Plant epiphytic, caespitose, small. Rhizomes short, roots filiform, < 1 mm in diameter. **Pseudobulbs** compressed, obovoid-ellipsoid, 1–1.5 cm long, 4 mm wide, concealed at the base by ca. 4 leaf sheaths, apex 1-foliate. **Leaves** equitant, sessile, linear-lanceolate to ovate-lanceolate, 4–7 cm long, 3–5 mm wide, acute to acuminate. **Inflorescence** a simple subumbellate raceme or panicle with subumbellate branches, each subumbel with 5–6 flowers; peduncle slender, 4.5–6 cm long, with several triangular, funnellform bracts 1.5–2 mm long; ovary with pedicel to 9 mm long, subtended by a scarious, lanceolate, spreading, acute to acuminate floral bract 1.5–2 mm long. **Flowers** small; sepals white, hyaline; petals lavender tinged with rose-purple near the base; lip and column purple. **Sepals** similar, linear-lanceolate, acuminate; dorsal ca. 10 mm long, 1.25 mm wide; lateral sepals slightly oblique, 1.2–1.3 cm long, 1 mm wide. **Petals** similar to the dorsal sepal but slightly narrower, ovate-lanceolate, abruptly attenuate toward the apex, ca. 1 cm long, 1 mm wide. **Lip** free from the column, with claw 4 mm long; blade with a basal isthmus, provided at the base with an obscurely papillose thickening and 2 retrorse auricles, then abruptly hastate, acuminate, to 5 mm long, 2 mm wide; lateral lobes somewhat recurved, serrate; apex strongly acuminate. **Column** slender, ca. 4 mm long with prominent foot; anther subglobose; pollinia 2, pyriform, strongly compressed, long triangular stipe.

Macroclinium cordesii is a rare species from the coastal plains of the Province of Limón. Flowering late August to October. Costa Rica and Panama.

Among Costa Rican *Macroclinium* species (especially *M. paniculatum* (Ames & C. Schweinf.) Dodson) with subcapitate inflorescences, *M. cordesii* may be distinguished by the straight, not abruptly reflexed, column and the conspicuous pseudobulbs.

Macroclinium doderoi Mora & Pupulin, Selbyana 18:7. 1997. TYPE: Costa Rica, Province of Cartago, Turrialba, Caño Seco Torito, *Dressler et al. s.n.* (holotype: USJ; isotype: USJ).

Plant epiphytic, pendent. Rhizome short; roots filiform, ca. 1 mm in diameter. **Pseudobulbs** inconspicuous, elliptic-obovate, ca. 3.5 mm long, 2 mm wide, concealed by 3–5 leaf sheaths, apex 1-foliate. **Leaves** conduplicate, compressed, lanceolate to narrowly elliptic-lanceolate, 1.2–1.8 cm long, 2 mm wide, acute, articulate to the imbricate sheaths with hyaline, scarious margins. **Inflorescence** a simple subumbellate raceme or panicle with many subumbellate branches produced successively from the last bud below the rachis of the terminal flower cluster, lax, to ca. 4 cm long, with 5–6 flowers per subumbel; ovary with pedicel subclavate, ca. 7 mm long, subtended by a shorter, triangular, acuminate, floral bract. **Flowers** large for the plant, tepals white, hyaline, petals with a purple blotch near the base; column and lip lavender to purple. **Sepals** similar; dorsal lanceolate, ca. 9 mm long, 1.6 mm wide, attenuate; lateral sepals narrowly lanceolate, ca. 1.1 cm long, 1.1 mm wide, long-attenuate. **Petals** ovate-lanceolate, falcate, ca. 9 mm long, 1.3 mm wide, attenuate. **Lip** free, inserted at a very narrow angle with the column, with short claw 0.9 mm long; blade slightly incurved toward the column, abruptly sagittate, ca. 7.5 mm long, 2 mm wide at midpoint, with 2 short, twisted lobes near the base; margins erose-dentate; callus none. **Column** terete, slender, 5.5 mm long, with abruptly reflexed apex; anther cucullate, narrowly ovate-triangular; pollinia 2, ovate-pyriform, strongly compressed, with long triangular stipe with lateral projections apically; viscidium elliptic, brown.

Epiphytic and endemic in moist tropical forests of the Central Valley of Costa Rica. Flowering late June through August.

Macroclinium doderoi may be easily distinguished from its Costa Rican relatives by a unique combination of characters including the subcapitate inflorescence, the lip entirely free from the column, the very short claw, and the absence of a callus between the lateral lobes of the lip.

Macroclinium generalense Pupulin, Lindleyana 11:136–138. 1996. TYPE: Costa Rica, San

José, Pérez Zeledón, Alto de San Juan, *Pupulin* 24 (holotype: USJ). Figure 32D.

Plant epiphytic, small, caespitose. Rhizome short; roots filiform, glabrous. **Pseudobulbs** inconspicuous, compressed, ellipsoid, to 5 mm long, 4 mm wide, concealed by 3–5 leaf sheaths, apex 1-foliate. **Leaves** conduplicate, laterally flattened, lanceolate to narrowly elliptic-lanceolate, to 4 cm long, 1 cm wide, acute, the basal leaves articulate to imbricate sheaths provided with broad, hyaline, scarious margins. **Inflorescence** subumbellate, with lateral, subumbellate branches produced consecutively from the last bract of the inflorescence below the rachis, few-flowered, to 11 cm long, provided at the base with 3–5 conspicuous, ovate, concave, acute bracts 8–11 mm long, 5 mm wide; ovary with pedicel subclavate, to 6 mm long, subtended by a lanceolate, acuminate floral bract to 4 mm long. **Flowers** small, hyaline, sepals white, petals pale rose spotted with purple, lip lavender. **Sepals** similar; dorsal lanceolate-elliptic, cucullate, to 1.2 cm long, 3.5–4 mm wide, acuminate; lateral sepals free, dorsally carinate, oblong-lanceolate, ca. 1.1 cm long, 3–3.5 mm wide, acuminate. **Petals** obliquely lanceolate, acuminate, to 1.2 cm long, 3.5 mm wide. **Lip** shortly clawed, sagittate, to 1.1 cm long, acuminate; claw linear, ca. 2 mm long, with more than $\frac{1}{2}$ adnate to column base; blade with 2 short, retrorse, twisted auricles at the base and 2 membranous, slightly thickened, glabrous calli between the auricles; basal portion of the blade narrowly linear cuneate, gradually expanded into the distal, triangular-rhombic portion, with irregular margins, apex acuminate. **Column** slender, abruptly dorsally reflexed at the apex; anther triangular, cucullate; pollinia 2, pyriform, strongly compressed laterally on a long triangular, hyaline stipe; viscidium elliptic, brown.

Epiphytic and endemic in the northern part of the Valle del General in Costa Rica. Flowering January through April.

The triangular-rhombic blade of the lip with the short claw adnate to the column and the presence of two membranous, glabrous calli easily distinguish *M. generalense* from its close allies, especially *M. glicensteinii* J. T. Atwood.

Macroclinium glicensteinii J. T. Atwood, Selbyana 10:60. 1987. TYPE: Costa Rica, Vara Blanca, OIC 7473 (holotype: SEL). Holotype originally collected by L. Glicenstein.

Plant epiphytic, caespitose, small. Rhizome short; roots filiform, to 1 mm in diameter. **Pseudobulbs** ovate, compressed, inconspicuous, to 4 mm long, concealed by the base of leaf sheaths, apex 1-foliate. **Leaves** sessile, conduplicate, laterally flattened, narrowly elliptic, 2–4 cm long, 3 mm wide; sheaths with conspicuous hyaline margins. **Inflorescence** subumbellate, sometimes with more than a subumbel developing from the same peduncle; peduncle slender, with lanceolate subulate bracts each sometimes developing a subumbel basipetally; ova-

ry with pedicel 1 cm long, subtended by a lanceolate floral bract 3–4 mm long. **Flowers** small, pale lavender with spotting mostly on the petals. **Sepals** similar, subconduplicate, narrowly elliptic-attenuate, 1.1–1.4 cm long, 1.5 mm wide. **Petals** lanceolate-attenuate, 8–12 mm long, to 1.5 mm wide. **Lip** free from the column, with a short claw, 3.5 mm long, presenting 2 auricles and 2 membranous calli apically, below which are numerous papillae and between which are transverse hairs; blade of the lip hastate, 5–7 mm long, 2–2.5 mm wide, acuminate, with irregularly crenulate margins, the apex strongly acuminate. **Column** slender, the apex abruptly dorsally reflexed, 7–8 mm long; anther cap ovate-subulate; pollinia 2, pyriform, strongly compressed, with long cuneate stipe.

Originally described from a cultivated specimen, *M. glicensteinii* is endemic to Costa Rica, where it probably lives in moist montane forests in the region of Dota. Flowering in cultivation (Connecticut) in December.

The presence of a few long, transverse hairs on the callus at the base of the blade of the lip and the short claw completely free from the column are distinct features for field recognition. This species is known only by the type collection.

Macroclinium lineare (Ames & C. Schweinf.)

Dodson, Icon. Pl. Trop. 10: t. 938. 1984. *Notylia linearis* Ames & C. Schweinf., Sched. Orch. 8:72. 1925. TYPE: Costa Rica, La Fuente, East Turrialba, Alfaro s.n. (holotype: US).

Plant epiphytic, caespitose, small. Roots filiform. **Pseudobulbs** elliptic, to 7 mm long, 3 mm wide. **Leaves** conduplicate, spreading, laterally flattened, semielliptic to linear-oblong, sharply acute, sessile, 1–3 cm long, 2.5–4.5 mm wide; imbricate sheaths with broad, scarious, hyaline margins. **Inflorescence** subumbellate, semiglobose; peduncle slender, flexuous, suberect, to 4 cm long, with 3 funnelform, acuminate bracts; ovary with pedicel subclavate, 7 mm long, subtended by a narrowly lanceolate, acuminate, concave, spreading, floral bract 1.8–2 mm long. **Flowers** large for the plants; sepals white, hyaline; petals tinged with rose-purple; lip purple. **Sepals** similar; dorsal strongly concave, narrowly lanceolate, dorsally conspicuously carinate, ca. 1 cm long, 1.8–2 mm wide, apex caudate-acuminate; lateral sepals free or very shortly connate forming a saccate base, lanceolate-linear, 1.2–1.3 cm long, 1 mm wide; apex long acuminate and conduplicate. **Petals** similar to the dorsal sepal, 9–10 mm long, ca. 1.5 mm wide, caudate. **Lip** free from the column, linear, contracted near the base, tapering to the carinate tip, 5–9 mm long, ca. 1 mm wide above the middle, shortly acuminate, with a clump of low, approximate papillae near the base. **Column** slender, ca. 3 mm long; pollinia 2, pyriform, strongly compressed, with long cuneate stipe.

Epiphytic and rare in wet premontane forests at the typical locality near Turrialba, along the At-

lantic slopes of Parque Nacional Braulio Carrillo, and in northern Valle del General at 1100–1200 m. Flowering at least August and September. Costa Rica, Panama, Colombia, and Ecuador.

Macroclinium lineare is unmistakable for its linear lip lacking auricles and for the clump of slender papillae at the base.

Macroclinium paniculatum (Ames & C. Schweinf.) Dodson, Icon. Pl. Trop. 10: t. 938. 1984. *Notylia paniculata* Ames & C. Schweinf., Sched. Orch. 10:102. 1930. TYPE: Costa Rica, Cartago, vicinity of Pejivalle, *Standley & Valerio* 46858 (holotype: AMES).

Plant epiphytic, caespitose, small. Rhizome short; roots filiform, < 1 mm in diameter. **Pseudobulbs** inconspicuous, suborbicular, compressed, sulcate, 7 mm long, 5 mm wide; concealed by 4 scarious, leaf sheaths; apex 1-foliate. **Leaves** densely rugose, conduplicate, laterally flattened, narrowly lanceolate to narrowly elliptic-lanceolate, 2.5–3.5 cm long, 3.5–5 mm wide, acute. **Inflorescence** subumbellate, subequaling or surpassing the leaves, commonly with successive short branches, few-flowered in each branch; floral bracts scarious, lanceolate, spreading, 3–3.5 mm long, much shorter than the ovary with pedicel 6 mm long. **Flowers** large for the plant; sepals white, hyaline; petals pinkish white tinged with rose-purple; lip purple. **Sepals** dissimilar; dorsal ovate-lanceolate, cucullate, 6–7 mm long, 1.2–1.6 mm wide, shortly acuminate; lateral sepals nearly $\frac{1}{2}$ connate, each oblong-lanceolate, dorsally carinate near the apex, ca. 9 mm long, 1.2–1.3 mm wide, mucronate. **Petals** ovate-lanceolate, 6–7 mm long, 1.8–2 mm wide, acuminate. **Lip** free from the column, with a long claw slightly dilated and thickened near the blade; the blade sagittate at the base, 3 mm long, 2 mm wide, the upper $\frac{1}{2}$ triangular-cordate, apex sharply mucronate; margins irregularly crenate; callus consisting of a central, longitudinal fleshy keel and a pair of fleshy auricles at the base of the blade. **Column** slender below, dilated above, 2.3 mm long; anther subglobose; pollinia 2, pyriform, strongly compressed, with long stipe.

Epiphytic and rare in premontane wet forests at 600–800 m. Flowering at least February (type) and April. Nicaragua to Costa Rica.

The sagittate lip with callus consisting of a central keel and fleshy auricles at the apex of the claw and the cordate, mucronate anterior portion of the blade are useful characters for field recognition.

Macroclinium ramonense (Schltr.) Dodson, Icon. Pl. Trop. 10: t. 939. 1984. *Notylia ramonensis* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 250–251. 1923. TYPE: Costa Rica, Santiago de San Ramón, *Brenes* 91 (isotype: CR). Figure 33B.

Plant epiphytic, small, caespitose, pendent. Rhizome short; roots filiform, < 1 mm in diameter. **Pseudobulbs** obovate-ellipsoid, compressed, ca. 1.5 cm long, 5–6 mm wide, protected at the base by 2–5 conduplicate leaf-bearing sheaths; apex 1-foliate. **Leaves** rugulose, conduplicate, laterally flattened, ligulate-lanceolate, subfalcate, acute, to 4.5 cm long, 4–8 mm wide; basal leaves articulate to sheaths provided with conspicuously hyaline, scarious margins. **Inflorescence** a pendent raceme, with many flowers (to 30), to 13 cm long, provided with triangular, acute bracts ca. 1.5 cm long; ovary with pedicel linear-subclavate, ca. 8 mm long, subtended by a lanceolate, acuminate, spreading floral bract 3 mm long. **Flowers** large for the genus, sepals white, petals pale lavender with purple blotches, lip lavender. **Sepals** subequal; dorsal linear-lanceolate, concave, acuminate, 1.7 cm long, 2.1–2.5 mm wide; lateral sepals obliquely linear-lanceolate, slightly concave, acute, 1.6–1.7 cm long, ca. 2 mm wide. **Petals** obliquely linear-lanceolate, long-attenuate, ca. 1.3 cm long, 1.9 mm wide. **Lip** with a linear, terete, slender claw 1.8 mm long, shortly adnate to the column; blade 6.5 mm long, 3.7 mm wide at the middle, the base with a pair of short, rounded, twisted auricles, then abruptly anchor-shaped; apex sharply attenuate; margins erose; callus between the auricles glabrous, narrowly elliptic. **Column** slender, terete, ca. 3 mm long; anther ovate-cucullate, truncate; pollinia 2, subtriangular, strongly compressed on a long, triangular, attenuate stipe; viscidium elliptic, brown.

Native to moist evergreen forests at 950(type)–1500 m. Flowering at least August and September. Costa Rica and western Panama.

Among Costa Rican species of *Macroclinium*, *M. ramonense* has the widest distribution, ranging from Monteverde southward along the Cordillera de Tilarán to southern and western drainage of Cordillera Central just to the western slopes of Cerro Vueltas of the Dota region. Among the species with elongate, rather than condensed, racemes, it is easily distinguished by the anchor-shaped blade of the lip and the narrowly elliptic callus. The long claw of the lip and prominent, central callus readily distinguish this from *M. bicolor*, with which it has been confused.

Macroclinium robustum Pupulin & Mora, Selbyana 18:7–10. 1997. TYPE: Costa Rica, Province of San José, Alajuelita, *Pupulin & Flores* 315 (holotype: USJ; isotype: USJ).

Plant epiphytic, caespitose, pendent. Rhizome short; roots filiform, ca. 1 mm in diameter. **Pseudobulbs** ovate, to 8.5 mm long, 5 mm wide, concealed at the base by 2–5 leaf sheaths with hyaline, scarious margins. **Leaves** rugose, compressed, 5.3–6.2 cm long, 5–7 mm wide, acute, the basal leaves articulate with their sheaths. **Inflorescence** a lax raceme with 11–17

flowers, to 8.6 cm long, the base provided with 2 triangular, acute bracts 8 mm long; ovary with pedicel linear-subclavate, ca. 8 mm long, subtended by a triangular, acuminate, floral bract ca. 4.5 mm long. **Flowers** rather large for the genus; sepals greenish white, petals lavender with purple blotches, lip lavender. **Sepals** similar; dorsal concave, lanceolate, acuminate, dorsally carinate, 1.2–1.3 cm long, 3–3.5 mm wide; lateral sepals slightly concave, linear-lanceolate, 1.4–1.5 cm long, 1.8 mm wide, acute. **Petals** sigmoid, ovate-lanceolate, ca. 1.2 cm long, 1.5 mm wide, long-attenuate. **Lip** shortly adnate to the column; claw linear, terete, 3.2 mm long; blade inflexed toward the column 6 mm long, 2.6 mm wide, with 2 short, subquadrate, twisted lobes near the base, abruptly sagittate-cordate at the middle, margins erose; disk verruculose, with a papillose-hirsute callosity. **Column** short, terete, slender at the base, 3 mm long, thickened abruptly at the reflexed apex; anther ovate-cucullate, apically mucronate; pollinia 2 ovate, strongly compressed; stipe triangular-elongate; viscidium elliptic, yellow.

Epiphytic and endemic in montane cloud forests of Costa Rica at 1850 m. Flowering late July and August.

In the type locality, this species was found growing exclusively on the introduced cypress *Cupressus lusitanicus*. *Macroclinium robustum* is the highest-growing species in Costa Rica and is unique for having both elongate inflorescences and flowers with papillose-hirsute calli. The long and stout claw easily distinguishes it from its closest relative, *M. ramonense* (Schltr.) Dodson.

Key to the Species of *Mesospinidium*

- 1a. Lip 6–8 mm long, dorsal sepal oblong *M. warscewiczii*
- 1b. Lip 4–6 mm long, dorsal sepal suborbicular *M. horichii*

Mesospinidium horichii Bock, *Orchidee* (Hamburg) 47:246. 1996. TYPE: Costa Rica, Atlantic rain forest, Sarapiquí jungles, near Cariblanco (holotype: HAL 75286, not seen). Figure 33C.

Plant a caespitose epiphyte to 30 cm tall. Rhizome short; roots 1–2 mm in diameter. **Pseudobulbs** small, lanceolate to ovoid, compressed, 3.5–4.5 cm long, 1.8–2 cm wide, subtended by 2–3 foliaceous, bracts, apically 1(2)-foliate. **Leaves** rather thin, carinate beneath, oblong-lanceolate to elliptic, 15–30 cm long, 3 cm wide, acute. **Inflorescence** a panicle of 15–20 flowers, lateral, 25–30 cm long with scape, pendent or arcuate, the peduncle covered by triangular, membranaceous bracts 7–9 mm long, 2–3 mm wide; ovary with pedicel 6–7 mm long; floral bract about 1 mm long. **Flowers** somewhat fleshy, 8–10 mm tall, 6–7 mm wide, yellowish with brownish spots. **Sepals** dissimilar;

Mesospinidium Rchb. f.

(D. E. Mora de Retana)

REFERENCE—N. H. Williams, A Reconsideration of *Ada* and the glumaceous brassias (Orchidaceae). *Brittonia* 24:93–110. 1972.

Epiphytic, caespitose **herb** of shady cloud and elfin forests. **Pseudobulbs** lanceolate to ovoid, little compressed laterally, subtended by 2 or more foliaceous sheaths; apex 1–2-foliate. **Leaves** light green, flexible, conduplicate, petiolate, acute to acuminate. **Inflorescence** arcuate or pendent, lateral at the pseudobulb base, usually paniculate, a raceme in young plants. **Flowers** fleshy, campanulate, greenish spotted with brown, the lip usually white or cream spotted with reddish brown. **Sepals** dissimilar, the laterals partially united. **Petals** ovate, acute, spreading. **Lip** simple, ovate to obovate, convex apically, margins usually revolute; callus a pair of fleshy keels at the base forming a concave depression. **Column** stout, without foot; pollinia 2, waxy, with relatively large stipe. **Fruit** a capsule.

A small genus of six to eight species ranging from southern Nicaragua (Volcán Mombacho) to Andean South America. *Mesospinidium* is rather easily recognized by the small, brown-spotted, greenish flowers on arcuate to pendent panicles. Plants are grayish green.

According to Williams, *Mesospinidium* is related to *Ada* and *Brassia*. No studies of DNA have been published that include this genus.

dorsal adnate to the petals at the base, papillose above, suborbicular, concave, apiculate, 5–6 mm long, 4–5 mm wide; lateral sepals elliptic, obtuse, 2/3 connate, prominently carinate, papillose above, 6–7 mm long, 3–4 mm wide. **Petals** lightly concave, acute to obtuse, recurved, 4–5 mm long, 2–3 mm wide. **Lip** simple, fleshy, articulate to the column base; blade ovate to suborbicular, or rhombic, 4–5 mm long, 3 mm wide; apex with reflexed apicule appearing emarginate in natural position; margin revolute; callus at the base fleshy, concave, bilamellate, pubescent between the lamellae. **Column** stout, 4 mm long, broadened at the base forming a prominent, rounded nectary, the margins with 2 lateral fleshy projections; pollinia 2, globose, with prominent stipe and viscidium.

This species grows in premontane rain forests at 800–1000 m. Flowering September and Octo-

ber. Costa Rica; also reported from Panama (R. L. Dressler, pers. comm.).

This species is distinguished from similar *M. warscewiczii* Rchb. f. by the smaller, fleshier flowers with suborbicular dorsal sepal and by the shorter lip. The name, *M. endresii* (Kraenzl.) Garay, has been misapplied to *M. horichii*.

Mesospinidium warscewiczii Rchb. f., Bot. Zeitung (Berlin) 10:929–930. 1852. Central America, *Warscewicz* (holotype: w). ?*Mesospinidium endresii* (Kraenzl.) Garay, Orchidee (Hamburg) 24:187. 1973. ?*Solenidium endresii* Kraenzl., Pflanzenr. 80:317. 1922. TYPE: probably Costa Rica, *Endres* (holotype: w). Figure 33D.

Plant a caespitose epiphyte to 25 cm tall. Rhizome short; roots to 1 mm in diameter. **Pseudobulbs** elliptic-ovoid, compressed, 2.3–3.5 cm long, 1.5–2 cm wide, subtended by 2–4 foliaceous bracts; apex 1(2)-foliate. **Leaves** petiolate; blade elliptic-lanceolate, subcoriaceous, carinate beneath, 10–25 cm long, 2.8–3.5 cm wide, acute. **Inflorescence** a panicle with 10–15 flowers, lateral, arcuate or subpendent, 20–25 cm long including the scape; scape concealed by lanceolate bracts to 7 mm long; ovary with pedicel 5–7 mm long. **Flowers** 9–13 mm tall, 6–8 mm wide, greenish yellow, tepals with red-maroon spots; lip white with orange-brown spots. **Sepals** dissimilar; dorsal free, oblong, concave, acute, 7–8 mm long, 4–5 mm wide; lateral sepals elliptic-ovate, carinate beneath, 11–12 mm long, 4–5 mm wide, the base $\frac{2}{3}$ connate, the apices acute. **Petals** elliptic-lanceolate, porrect, somewhat concave, 5–6 mm long, 2–3 mm wide, acute. **Lip** simple, fleshy, obovate to subpandurate, 6–8 mm long, 4–5 mm wide, with rounded nectary at the base, the apex acute and reflexed appearing retuse, the margin somewhat plicate; callus at the base a pair of fleshy keels to about $\frac{2}{3}$ the lip, pubescent. **Column** stout, 5 mm long, broadly canaliculate; pollinia 2, waxy, rounded, with viscidium and triangular stipe.

This species grows usually as small populations in premontane cloud forests at 600–1200 m. Flowering October to December. Reported from Nicaragua to Panama.

Mesospinidium warscewiczii differs from similar *M. horichii* Bock by the larger, less fleshy flower, the oblong dorsal sepal, and the notably larger lip.

Miltoniopsis Godefroy-Leb.

(D. E. Mora de Retana)

REFERENCE—L. A. Garay and G. C. K. Dunsterville, Venez. Orch. Ill. 6:276–278. 1976.

Epiphytic, caespitose **herb** of rather wet, usually mid-elevation habitats. **Pseudobulbs** ovoid, strongly compressed, subtended by 2 or more foliate sheaths, apex 1-foliate. **Leaves** conduplicate, soft and flexible, articulate. **Inflorescence** a lateral raceme at the base of the pseudobulb. **Flowers** large and showy. **Sepals** free, spreading. **Petals** similar to the sepals, recurved or reflexed, spreading. **Lip** larger than sepals or petals, united to column base by a central keel, with a pair of sharp, short, lateral lobes at the base. **Column** stout, without auricles or foot; pollinia 2, with stipe and viscidium. **Fruit** a capsule.

A genus of about six species ranging from Costa Rica to Andean South America. Two species are known in Panama, but only one is known in Costa Rica.

Little is known of the close relationships of *Miltoniopsis*. The 1-foliate pseudobulb, lip with both central keel adnate to the column, and the sharp lateral lobes are clearly inconsistent with *Miltonia*. Still, *Miltoniopsis* seems to belong to the *Oncidium altissimum* clade (see Chase & Palmer, 1992), including *Odontoglossum* and *Oncidium* (in part).

Miltoniopsis warscewiczii (Rchb. f.) Garay & Dunsterville, Venez. Orch. Ill. 6:278. 1976. *Odontoglossum warscewiczii* Rchb. f., Bot. Zeitung (Berlin) 10:692–693. 1852. TYPE: Panama, Chiriquí at 8000 ft, *Warscewicz* (holotype: w). *Odontoglossum warscewiczianum* Hemsley, Biol. Centr.-Amer. 3:277. 1883. *Miltonia endresii* Nicholson Ill. Dict. Gard. 2:368. 1888. *Miltonia superba* Schltr., Repert. Spec. Nov. Regni Veg. 3:249. 1907. Figure 34A.

Plant caespitose, epiphytic, gray-green, 20–30 cm tall. Rhizome short; roots 2 mm in diameter. **Pseudobulbs** ovoid-ellipsoid, 3.8–4.3 cm long, 1.5–2.5 cm wide, apically 1-foliate, subtended and nearly concealed by 4–6 foliaceous bracts arranged in a fan. **Leaves** and foliaceous bracts articulate, petiolate; blades abaxially carinate, oblong-elliptic, acute to acuminate, to 30 cm long, 2–3 cm wide. **Inflorescence** a lateral, 3–5-flowered raceme 25–30 cm long including the scape; scape with translucent, triangular bracts; ovary and pedicel 3.5–4.5 cm long subtended by short, acute bracts 4–6 mm long. **Flowers** very delicate, 4.5–6 cm high and 4.2–6 cm wide, white to pink with a wine red to salmon spot around the yellow callus; column white to magenta with white anther. **Sepals** 2.5–3.2 cm long, 1.2–1.6 cm wide; dorsal elliptic-obovate, erect, concave, obtuse and apiculate; lateral sepals elliptic to obovate, lightly reflexed, obtuse and apiculate when spread. **Petals** similar to the sepals, obovate, 2.8–3 cm long, 1.3–1.4 cm wide; apex recurved, obtuse, apiculate. **Lip** pandurate, broad, 3.5–4 cm long, about as wide; apex deeply emarginate, united to the column base by a narrow keel; callus at the base semicircular with fleshy and lightly elevated border. **Column** stout, 4–5 mm long; pollinia 2, waxy, with vis-

cidium and short stipe. **Capsules** ellipsoid, 6–7 cm long including the beak; pedicel ca. 2 cm long.

Miltoniopsis warscewiczii grows in high tree crowns in premontane and lower montane cloud forests (the “rainbow zone”) at 1000–1800 m, rarely at lower elevations in the area of La Virgen de Sarapiquí. Flowering October to December. Reported from Costa Rica and Panama.

In flower, this species is easily recognized by the large, white, rather flat flowers with a proportionately large, biblike lip. Sterile plants could be confused with *Ada chlorops* (Endr. & Rchb. f.) N. H. Williams, a species with smaller, nearly obsolete pseudobulbs and deeper-green leaves. They often grow together.

This species is most closely related to the South American *M. vexillaria* (Rchb. f.) Godefroy-Lebeuf, a species with somewhat larger and much more variably colored flowers. Both *Odontoglossum warscewiczianum* Hemsley and *Miltonia endresii* Nicholson are based on the same type as *Odontoglossum warscewiczii* Rchb. f.

Notylia Lindl.

(D. E. Mora de Retana, with help from R. L. Dressler)

Plant a small caespitose, sympodial, pseudobulbous epiphyte; rhizomes short; roots usually white, thin, cy-

lindric. **Pseudobulbs** conspicuous or hidden by 1 or more foliaceous sheaths, apex 1-foliate. **Leaves** conduplicate, usually broad and leathery. **Inflorescence** a lateral, pendent, or arcuate raceme borne at the base of the pseudobulb, usually many-flowered. **Flowers** small, usually white to cream or pinkish, often faintly spotted, subtended by narrow, acute bracts. **Sepals** narrow and acute, variously spreading; the lateral sepals usually variously connate, sometimes completely so. **Petals** similar to the sepals but narrower. **Lip** arrowhead-shaped or trulliform, acute and often attenuate, sometimes united to the base of the column. **Column** variously elongate, cylindric, straight, without a foot, without wings, with variously elongate rostellum, anther dorsal, enlarged; pollinia 2, waxy, supported on an elongate stipe and viscidium. **Fruit** a capsule.

A perplexing Neotropical genus of perhaps 50 species, many of which are extremely similar and difficult to distinguish. Three species are here treated for Costa Rica, although there may be at least one more (see note under *N. lankesteri*).

Notylia is most closely related to *Macroclinium* Barb. Rodr. (see Chase & Palmer, 1992), which is distinguished by the equitant leaf, often monopodial habit, usually subumbellate inflorescence, and more complex flowers. *Notylia* species have 1-foliate pseudobulbs and pendent lateral inflorescences with usually many flowers that have a characteristic appearance, even when out of flower.

Key to the Species of *Notylia*

- 1a. Lateral sepals free to base 2
 - 2a. Lip narrowly acute *N. trisepala*
 - 2b. Lip subovate, obtuse *N. lankesteri*
- 1b. Lateral sepals at least ½ connate *N. pittieri*

***Notylia lankesteri* Ames, Sched. Orch. 5:34. 1923.**
TYPE: Costa Rica, Province of Limón, Rio Estrella, sea level, *Lankester & Sancho 373* (AMES, photo seen). ?*N. brenesii* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:249. 1923. **TYPE:** Costa Rica, San Pedro de San Ramón, *Brenes 173* (lectotype: CR; isotype: AMES, photo seen).

Plant caespitose, to about 15 cm tall. **Pseudobulb** ovoid, ca. 1.5 cm long, 1 cm wide. **Leaves** oblong-elliptic, rounded at the base, obtuse, 11–14 cm long, 2–3.5 cm wide. **Inflorescence** a lateral raceme 4–16 cm long, densely flowered; floral bracts 4–5 mm long. **Flowers** aromatic, fleshy, white; petals with orange spots. **Sepals** similar, ca. 5 mm long, 3 mm wide; dorsal concave; lateral free, elliptic-ovate. **Petals** elliptic, obtuse, ca. 4 mm long, 2.5 mm wide, thickened at the

unguiculate base. **Lip** short-unguiculate; ca. 4 mm long, 2–2.5 mm wide; blade ovate to lanceolate, acute, the tip compressed; margins ascending; callus triangular, erect near the base. **Column** fleshy, stout, ca. 3 mm long.

Epiphytic in moist forests at 0–1500 m. Flowering at least November. Apparently endemic to Costa Rica.

Notylia lankesteri is distinguished from other species by the free sepals and obtuse lip. The sepals and petals are notably fleshy. The original description indicates that the flowers are “pungently spicy.” Much of the above description is taken from the original description.

One of our reviewers analyzed a flower from the type of *Notylia brenesii* Schltr. and found that

the lip is long-attenuate as described and similar in shape to an elephant's trunk. This may prove to be different from the species here described.

Notylia pittieri Schltr., Beih. Bot. Centralb. 36(2):418. 1918. TYPE: Costa Rica, Sur les Crescentia a Boruca, *Pittieri* 6850 (AMES, drawing of type). Figures 34C,D.

Plant epiphytic, caespitose, forming small clumps ca. 12 cm tall. Rhizome very short; roots slender, ≤ 1 mm in diameter. **Pseudobulbs** ovate to oblong, apically 1-foliate, somewhat flattened, sulcate, 0.5–3.5 cm long, 0.4–1 cm wide, subtended by 2–3 foliaceous bracts. **Leaves** somewhat fleshy, oblong to elliptic-lanceolate, 3–17 cm long, 0.8–3.5 cm wide, shortly petiolate, acute. **Inflorescence** a densely and successively flowered, pendent raceme, 3–20 cm long; ovary with pedicel 3 mm long, subtended by shorter, triangular, acute bracts. **Flowers** somewhat spreading, with tannish cream sepals; petals cream with brown-orange spots; lip white. **Sepals** dissimilar; dorsal concave, ligular-lanceolate, 4–5.5 mm long, 1.6–1.7 mm wide; synsepals 3.7–4.5 mm long, 1.2–2.2 mm wide, minutely bidentate apically. **Petals** oblique, falcate-lanceolate, 3.3–4.5 mm long, 0.6–1.2 mm wide; acute and attenuate. **Lip** 3–3.7 mm long, 1–2.2 mm wide, with short claw ca. 0.5 mm long; blade subsagittate to lanceolate, acute, with prominent keel 1–1.5 mm on claw and base of the blade. **Column** slender, erect, 2–3 mm long; anther cucullate, elongate, pollinia 2, with stipe and small viscidium.

Epiphytic in moist and seasonally dry forests in Pacific lowlands at 0–500 m. Flowering March, April, and June to September. Costa Rica; to be expected in western Panama.

Notylia pittieri is distinguished by the green or tan-green sepals, the lateral sepals being nearly totally connate, and the trullate-lanceolate lip.

Notylia trisepala Lindl., Paxton's Fl. Gard. 3:45. 1852. TYPE: Guatemala, *Van Houtten* (K). ?*N. turrialbae* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:145–146. 1923. TYPE: Costa Rica, Turrialba, A. and C. Brade 1186 (AMES, drawing of type). *N. barkeri* of authors, not Lindl. Figure 34B.

Plant a caespitose epiphyte, ca. 15 cm tall. Rhizome very short; roots slender, ≤ 1 mm in diameter. **Pseudobulbs** ovoid, apically 1-foliate, largely concealed by 2–3 subtending bracts, 1–2.2 cm long. **Leaves** somewhat fleshy, abaxially carinate, elliptic to ovate-lanceolate, subpetiolate, obtuse, 5–13.5 cm long, 1.2–3 cm wide. **Inflorescence** a pendent raceme 12–25 cm long; ovary with pedicel 5 mm long, subtended by shorter, triangular, acute bracts. **Flowers** successive, white or greenish white, petals with orange-yellow bars near the base. **Sepals** free, similar; dorsal elliptic, 5–6 mm long, 1–2.5 mm wide; lateral sepals lance-elliptic to lance ovate, 4–6 mm long, 1–1.6 mm wide. **Pet-**

als similar to the sepals. **Lip** unguiculate, 3.5–5 mm long, 1–2 mm wide; blade triangular-ovate, acute, with prominent keel on claw and base of the blade. **Column** stout, 2.5–2.7 mm long; anther cucullate, elongate; pollinia 2, with stipe and small viscidium.

Epiphytic in moist forest at 100–900 m. Flowering January to April. Reported from Guatemala to Costa Rica; probably also in western Panama.

Notylia trisepala is distinguished by the white or greenish white flowers and free lateral sepals.

Oncidium Sw.

(D. E. Mora de Retana)

REFERENCES—Retana, D. E. M. de, and J. T. Atwood, Orchids of Costa Rica. 2. Icones Plantarum Tropicarum 15: pl. 1401–1500. 1992. Retana, D. E. M. de, and J. T. Atwood, Orchids of Costa Rica. 3. Icones Plantarum Tropicarum 16: pl. 1501–1600. 1993.

Epiphytic, rarely terrestrial, caespitose or rhizomatous herb. **Pseudobulbs** present to obsolete or absent, subtended by 0–several foliaceous bracts; apex 0–3-foliate. **Leaves** conduplicate, chartaceous to fleshy, flat to terete, petiolate to sessile, acute to obtuse. **Inflorescence** lateral at the pseudobulb base, a raceme of 1–several flowers or panicle. **Flowers** small to large, generally showy, usually yellow with reddish brown spots, sometimes white or with purple spots, rarely wine red to pink. **Sepals** similar or the laterals dissimilar and often variously connate. **Petals** usually similar to the sepals but somewhat smaller, rarely larger. **Lip** divergent from the column forming an angle of at least 90°, usually fleshy, simple or 3-lobate, the midlobe often emarginate or 2-lobate; callus often complex comprising various plates and teeth. **Column** stout, footless, with a fleshy plate below the stigma (tabula infrastigmatica), the apex with or without conspicuous wings; pollinia 2, waxy, supported on a conspicuous stipe and viscidium. **Fruit** a capsule.

A Neotropical genus of about 450 species depending in part on circumscription. Twenty-eight species are known in Costa Rica, although there may be others hiding under the synonyms we accept. Although we exclude *O. luridum* Lindl., it may occur in mangroves along the Atlantic coast, as reported both south and north of Costa Rica.

According to Chase, *Oncidium* includes several distinct alliances, some more closely related to other currently defined genera than to other oncidiums. The key to genera of the Oncidiinae allows one to arrive at *Oncidium* through several couplets reflecting the incoherent diversity of this polyphyletic “genus.”

Key to the Species of *Oncidium*

1a. Plants with a single, fleshy flat or terete apical leaf, no foliaceous bracts; pseudobulbs small or essentially obsolete	2
2a. Leaves terete (see Figs. 35A–C)	3
3a. Lateral lobes correct, column wings linear, curved	<i>O. ascendens</i>
3b. Lateral lobes not correct; column wings otherwise, not linear	4
4a. Callus prominent, noselike in profile, with a pair of teeth near the base	<i>O. cebolleta</i>
4b. Callus not noselike, with 3 ridges apically but lacking teeth	<i>O. teres</i>
2b. Leaves flat, fleshy but never terete	5
5a. Flowers white with reddish purple spots, lip \leq 12 mm wide	<i>O. carthagenense</i>
5b. Flowers brown to yellow spotted with brown, lip $>$ 13 mm wide	<i>O. luridum</i> [see excluded taxa]
1b. Plants with 2 or more flat leaves including foliaceous bracts, never fleshy except perhaps in <i>O. ampliatum</i>	6
6a. Lip white or cream when young, sometimes turning yellow, never marked with red to brown	7
7a. Lip \geq 1.6 cm long	8
8a. Lip $>$ 2.5 cm long	<i>O. schroederianum</i>
8b. Lip $<$ 2.4 cm long	9
9a. Lip apex anchor-shaped, basal callus prominent	<i>O. cariniferum</i>
9a. Lip simple, without basal callus	<i>O. stenoglossum</i>
7b. Lip \leq 1.5 cm long	10
10a. Inflorescence very large, $>$ 1.5 m long	<i>O. ochmatochilum</i>
10b. Inflorescence relatively short, $<$ 1 m long	11
11a. Inflorescence bracts subtending primary branches \leq 1.5 cm long, not cymbiform	<i>O. panduriforme</i>
11b. Inflorescence bracts subtending primary branches \geq 2.5 cm long, cymbiform	<i>O. storkii</i>
6b. Lip yellow or greenish yellow when young, often marked with red to brown	12
12a. Inflorescence a raceme, or if not, pseudobulb never with purple spots (<i>O. planilabre</i> may produce a branch in robust specimens)	13
13a. Plant basically a vine; shoots at least 6 cm apart on wiry rhizome lacking bracts between shoots	<i>O. globuliferum</i>
13b. Plant caespitose, never a vine	14
14a. Foliaceous bracts subtending pseudobulbs 5–8	<i>O. cristagalli</i>
14b. Foliaceous bracts subtending pseudobulbs 2–3	15
15a. Tepals yellow; with cymbiform floral bracts enclosing the ovary mostly $>$ 1.5 cm long	<i>O. warscewiczii</i>
15b. Tepals brown with yellow margin; floral bracts lanceolate, $<$ 1.2 cm long, never enclosing ovary	<i>O. planilabre</i> [see excluded taxa]
12b. Inflorescence a panicle, pseudobulb various	16
16a. Inflorescence with small, infertile flowers in addition to the single fertile flower per primary branch	<i>O. bryolophotum</i>
16b. Inflorescence lacking small infertile flowers	17
17a. Primary inflorescence branches subtended by spreading, cymbiform bracts \geq 3 cm long	<i>O. bracteatum</i>
17b. Bracts subtending primary branches not as above	18
18a. Distance across lateral lobes \geq 2 \times greater than midlobe	19
19a. Leaves 5–7 per shoot, \geq 1.5 cm wide	<i>O. luteum</i>
19b. Leaves 3–4 per shoot, $<$ 1.5 cm wide	<i>O. cheirophorum</i>
18b. Distance across lateral lobes $<$ 2 \times width of midlobe, midlobe usually broader	20

- 20a. Pseudobulbs spotted with purplish brown 21
 21a. Foliaceous sheaths lacking, leaves somewhat fleshy
 *O. ampliatus*
 21b. Foliaceous sheaths present, leaves not fleshy 22
 22a. Tepals yellow with brownish midveins
 *O. obryzatoides*
 22b. Tepals not as above 23
 23a. Petals never spatulate, heavily blotched with
 brown or purple to $> \frac{3}{4}$ from the base; pseudo-
 bulb usually with 2 leaves *O. dichromaticum*
 23b. Petals distinctly spatulate, spotted only to $< \frac{1}{2}$
 from the base *O. klotzschianum*
 20b. Pseudobulbs not spotted with purplish brown 24
 24a. Flowers ≤ 1.5 cm tall *O. parviflorum*
 24b. Flowers > 1.5 cm tall 25
 25a. Tepals yellow stained with brown along midveins *O. obryzatoides*
 25b. Tepals dark brown or yellow spotted with brown 26
 26a. Pseudobulbs suborbicular to elliptic or ovate, strongly compressed, sharp-edged 27
 27a. Tepals nearly solid dark brown with yellow tips *O. ansiferum*
 27b. Tepals yellow with few brown spots *O. stenobulbon*
 26b. Pseudobulbs various, neither strongly compressed, nor suborbicular, rather lanceolate, ovoid
 or ellipsoid 28
 28a. Plants terrestrial; foliaceous sheaths without articulations, inflorescence erect
 *O. ensatum*
 28b. Plants epiphytic; leaves articulate, inflorescence pendent 29
 29a. Ovary with pedicel ≥ 2.5 cm long, pseudobulb ellipsoid with 1 apical leaf
 *O. stenotis*
 29b. Ovary with pedicel ≤ 2.5 cm long, pseudobulbs lanceolate, with 2–3 (rarely 1)
 apical leaves 30
 30a. Midlobe of lip about 2 \times as long as base below narrowest part of isthmus;
 lateral lobes pointing laterally, callus at least as broad as long *O. isthmi*
 30b. Midlobe about as long as base, lateral lobes somewhat porrect; callus nar-
 rower than long *O. polycladium*

Oncidium ampliatus Lindl., Gen. Sp. Orch. Pl.
 202. 1833. TYPE: Panama and Colombia, *Cum-
 ing 1312* (holotype: κ). *Oncidium bernoullian-
 um* Kraenzl., Pflanzenr. IV. 50(Heft 80):231.
 1922. TYPE: Guatemala, *Bernouli 339* (holo-
 type: w). Figure 38D.

Plant epiphytic, caespitose or shortly creeping. Rhi-
 zome short; roots 1.5–4 mm in diameter. **Pseudobulbs**
 green with reddish brown markings, ovoid to orbicular,
 laterally flattened, coarsely rugose, 3.5–10 cm long, 3.5–
 8 cm wide, concealed when young by nonfoliaceous
 bracts, apically (1)2–3-foliate. **Leaves** somewhat petio-
 late; blades coriaceous, elliptic, 6–35 cm long, 3–8.5 cm
 wide, subacute to obtuse. **Inflorescence** lateral, a raceme
 when small, panicle when large, 35–70 cm long includ-
 ing the scape; ovary and pedicel 2.5–4 cm long. **Flow-
 ers** somewhat successive, 2.5–3.5 cm long, 2.2–3.5 cm
 wide, brilliant yellow, the sepals somewhat spotted with
 red-brown, also the lip with reddish brown surrounding
 the callus. **Sepals** similar, 5–9 mm long, 5–7 mm wide,
 obovate-spatulate, concave. **Petals** larger than the sepals,

with claw; blade 8–13 mm long, 6–9 mm wide, subor-
 bicular. **Lip** 3-lobate, 1.8–3.5 cm long, 2.5–3.5 cm wide;
 lateral lobes small, 5–6 mm wide; midlobe reniform,
 emarginate, with undulate margins, forming a narrow
 isthmus basally; callus at the isthmus complex, fleshy,
 somewhat elevated, consisting of 2 teeth basally and 3
 teeth apically. **Column** short, 3–5 mm long, with dentate
 column wings; anther bed dentate; pollinia 2, supported
 on a viscidium and very short stipe. **Capsules** ellipsoid,
 retaining floral segments, 2.5–3.5 cm long; pedicel 2–
 3.5 cm long.

Uncommon epiphyte in dry, deciduous to sem-
 ideciduous forests of the Pacific lowlands at 0–
 800 m. Flowering December to April. Broadly
 distributed from Guatemala to Venezuela, Trini-
 dad, and Peru.

Oncidium ampliatus is easily recognized even
 when sterile by the strongly rugose, apically usu-
 ally 2–3-foliate pseudobulbs. The flowers are no-
 table for their proportionately enormous, yellow
 lips.

Oncidium ansiferum Rchb. f., Bot. Zeitung (Berlin) 10:696. 1852. TYPE: Chiriquí, Warscewicz (holotype: w, photo seen). *Oncidium lankesteri* Ames, Sched. Orch. 4:53. 1923. TYPE: Costa Rica, Irazú Volcano, Lankester & Sandro 415 (holotype: AMES). Figure 40A.

Plant caespitose, epiphytic. Rhizome abbreviated, shortly climbing; roots white, 1–2 mm in diameter. **Pseudobulbs** elliptic–ovoid, strongly flattened laterally, furrowed when dry, 6–12 cm long, 3–6 cm wide; base subtended by 2–3 imbricate, foliaceous, bracts; apex 1–2-foliate. **Leaves** short to long-petiolate, strongly carinate abaxially, 1–2(3) at the pseudobulb apex; blade elliptic-lanceolate, obtuse to subacute, coriaceous, conduplicate at the base, 15–40 cm long, 2.5–5.5 cm wide. **Inflorescences** lateral, 1–2 at the base of the shoot, an erect or arcuate panicle, exceeding the leaves, 50–80 cm long; branches 15–20 cm long, with 4–6 flowers; ovary with pedicel 2–3.5 cm long. **Flowers** with tepals reddish brown tipped with yellow, 3–3.5 cm in diameter; lip brilliant yellow with a brown border around the callus. **Sepals** and **petals** similar, free, reflexed, 1.5–1.7 cm long, 5–7 mm wide, with undulate margins. **Lip** 3-lobate, 1.5–2 cm long, 1.2–1.8 cm wide; lateral lobes small, rounded, 5–7 mm wide; midlobe emarginate, with denticulate margin; isthmus 3–5 mm wide; callus fleshy, consisting of 7 teeth, 5 in 1 plane, 2 lower at the apex. **Column** short, ca. 5 mm long, with prominent tabula infrastigmatica; column wings broad, dolabriform, with crenulate margins; anther papillose; pollinia 2, obovate, supported on a prominent stipe and viscidium. **Capsules** ellipsoid, 4.5 cm long; pedicel 2 cm long.

This species grows as a low-density epiphyte in cloud forests at (1000)1350–2200 m. Flowering December to June with peak in February to April. Costa Rica and Panama.

Oncidium ansiferum is easily recognized by the strongly compressed, sharp-edged pseudobulbs and by the tepals, which are dark brown with yellow apices. It is closely related to *O. stenobulbon* Kraenzl., which grows in dryer habitats, usually at lower elevations (800–1050 m). Plants of that species are more yellow-green and have shorter and proportionately broader leaves, yellow tepals spotted with less intense brown, and less pronounced column wings. From the regions of San Pedro and Santiago de San Ramón (850 and 1000 m, respectively) are two specimens that appear somewhat intermediate with *O. stenobulbon* and may represent natural hybrids.

The common name of “caite” has been applied to this species because the odd, flattened pseudobulbs are similar in shape to *caite*, a kind of sandal worn by campesinos.

Oncidium ascendens Lindl., Edwards’s Bot. Reg. 28: sub t. 4. 1842. TYPE: Guatemala. Figure 35A.

Plant an erect or pendent, caespitose epiphyte; rhizome short, roots to 2 mm in diameter. **Pseudobulbs** minute, suborbicular, 5–8 mm in diameter; subtended by non-foliaceous bracts; apex 1-foliate. **Leaves** terete, fleshy, dark green with reddish spots, 10–45 cm long, 6–1.2 cm in diameter, acute. **Inflorescence** lateral, paniculate, usually shorter than the leaf, 10–30 cm long including the scape; branches short; flowers congested; ovary with pedicel 7–8 mm long. **Flowers** with tepals greenish spotted with brown; lip yellow with spotted callus. **Sepals** similar, free, concave, shortly unguiculate, obovate, obtuse, 6–7 mm long, 3–5 mm wide. **Petals** similar to the sepals, shortly unguiculate, concave, obovate, obtuse, 6–8 mm long, 3–5 mm long, with undulate margins. **Lip** 3-lobate, 9–10 mm long, 8–9 mm wide; lateral lobes rounded, porrect, 3–4 mm long; midlobe emarginate to 2-lobate, reniform, forming a distinct isthmus at the base 2–3 mm wide. **Column** stout, about 3 mm long, with a pair of linear, curved wings apically; anther papillose; pollinia pyriform, supported on viscidium and oblancoolate stipe. **Capsules** ellipsoid, shortly beaked, 2.3 cm long; pedicel ca. 1 cm long.

Epiphytic in hot, humid, tropical lowland forests with a short dry season at 0–1000 m. Flowering January to March. Reported from Mexico to Costa Rica, Colombia, and the Caribbean.

Three terete-leaved species of *Oncidium* are recognized in Costa Rica, *O. ascendens*, *O. cebolleta* (Jacq.) Sw., and *O. teres* Ames & C. Schweinf. Of these species, *O. ascendens* is unique in the porrect lateral lobes and in the linear, incurved column wings.

The entire alliance around *O. ascendens* needs to be reexamined, and we make no attempt to repeat questionable synonymies published elsewhere.

Oncidium bracteatum Warsz. & Rchb. f., Bot. Zeitung (Berlin) 10:695. 1852. TYPE: Probably Panama, Chiriquí, Warscewicz (w). *Oncidium paleatum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:260–261. 1923. TYPE: Costa Rica, San Rafael de San Ramón, Brenes 206 (drawing of type: AMES). *Oncidium henricigustavi* Kraenzl., Pflanzenr. IV. 50(Heft 80):242. 1922. TYPE: Costa Rica, Endres 292 (w). Figure 38A.

Plant a caespitose epiphyte of large branches to 60 cm high; rhizome short; root 1–1.5 mm in diameter. **Pseudobulbs** ovate, compressed, sulcate, subtended by 2–4 foliaceous bracts, apex 1–2 foliate. **Leaves** elliptic-lanceolate, carinate abaxially, 15–40 cm long, 1.5–3.5 cm wide, conduplicate at the base; apex asymmetrically acute. **Inflorescence** lateral, paniculate, ≤ 1.25 m tall,

peduncle scarious; primary branches subtended by cym-biform bracts 3.5–4.5 cm long, the base with short internodes and usually with 2 imbricate bracts; ovary with pedicel 1.5–2.5 cm long, subtended by glumaceous bracts 1.5–2.8 cm long, 8–10 mm wide when spread. **Flowers** brilliant yellow marked with dark brown, lip brilliant yellow with brown base and isthmus. **Sepals** dissimilar, elliptic, carinate abaxially, narrowed at the base, with undulate margins; dorsal 1.3–1.5 cm long, 5–6 mm wide, obtuse, apiculate; lateral sepals falcate, reflexed or not, 1.5–1.7 cm long, 5–6 mm wide, acute. **Petals** similar to the dorsal sepal, 1.3–1.5 cm long, 5–6 mm wide, obtuse, apiculate, margins undulate. **Lip** 3-lobate, 1.3–1.6 cm long, 1.2–1.5 cm wide; lateral lobes at the base rounded, somewhat retrorse; midlobe reniform, deeply emarginate, forming a pair of rounded lobes; isthmus ca. 5 mm wide; callus fleshy, with a thick central keel, 4 lateral and 3 apical teeth. **Column** 6–8 mm long, tabula infrastigmatica with fleshy borders, wings slender; anther; pollinia, supported on an elongate stipe and viscidium. **Capsules** ellipsoid, 4.5–5 cm long; pedicel ca. 3 cm long.

Epiphytic on shady, larger branches in premontane and lower montane cloud forests at 1000–1700 m. Flowering mostly May to October; sporadically throughout the year. Costa Rica and Panama.

Oncidium bracteatum resembles *O. storkii* in the conspicuous inflorescence bracts, but the latter species has strictly secund branches and dull yellow flowers with much less pronounced lateral lobes.

The name *O. paleatum* has been misapplied to *O. stenotis* Rchb. f. (F. Hamer, Icon. Pl. Trop. 11: t. 1059), but the drawing of the type of *O. paleatum* shows a smaller, 2-foliate pseudobulb with very narrow leaves and long bracts subtending the primary branches of the inflorescence, which are consistent with *O. bracteatum*, not *O. stenotis*. Also, the original description of *O. paleatum* indicates a much smaller flower, consistent with *O. bracteatum*.

Oncidium bryolophotum Rchb. f., Gard. Chron. 738. 1871. TYPE: Central America, Veitch (w). *Oncidium megalous* Schltr., Repert. Spec. Nov. Regni Veg. 9:30. 1910. TYPE: Costa Rica, Esmeralda, Barba Massif, *Biolley 7256*. *Oncidium asparagoides* Kraenzl., Pflanzenr. IV. 50(Heft 80):175. 1922. TYPE: Costa Rica, *Endres 127* (w). *Oncidium microphyton* Kraenzl., Pflanzenr. IV. 50(Heft 80):204–205. 1922. TYPE: Costa Rica, *Endres s.n.* (w). Figure 37D.

Plant most variable in size, 10–25 cm tall; roots slender, about 1 mm in diameter. **Pseudobulbs** ovoid to lanceolate, little compressed, 2–8 cm long, 1.5–2.5 cm wide; subtended by 2–3 foliaceous bracts; apex 1–2-foliate. **Leaves** shortly petiolate, blades elliptic-lanceolate, 7–25 cm long, 1–2.5 cm wide, acute. **Inflorescence** lat-

eral, paniculate, 6 cm–1 m, complexly branched; primary branches to 5–10 cm long, with a single fertile and many aborted flowers per branch with oblong-linear tepals; ovary with pedicel 1–1.5 cm long. Fertile **flowers** ca. 1.2–2 cm tall, yellow with reddish brown markings on the tepals and lower half of lip. **Sepals** dissimilar; dorsal shortly unguiculate, ovate, acute, 7–9 mm long, 4–5 mm wide; lateral sepals linear-lanceolate, acute, reflexed, 9–10 mm long, 2–3 mm wide. **Petals** similar to the dorsal sepal, shortly unguiculate, 7–9 mm long, 4–6 mm wide. **Lip** 3-lobate, nearly as broad at the base as across the midlobe, 1–1.5 cm long, 1–1.5 cm wide; lateral lobes bluntly triangular, 3–4 mm long; midlobe 1–1.5 cm wide, deeply emarginate forming 2 rounded lobes; isthmus ca. 4–5 mm wide; callus at the base with a central blunt keel and 4 rows of blunt teeth with additional teeth on the lateral lobes. **Column** ca. 5 mm long, with tabula infrastigmatica, the apex with a pair of large, correct, rounded wings. **Capsules** 3.5 cm long including elongate beak, pedicel 1–1.5 cm long.

Epiphytic on larger branches of open canopies in premontane and lower montane cloud forests at 1000–2100 m. Flowering July to December. Costa Rica and Panama; probably to Peru.

Oncidium bryolophotum is easily distinguished by the asparagus-like, slender inflorescence, which is often seen waving in the wind. Each primary branch has a single fertile and numerous sterile flowers.

Plants from Costa Rica and Panama have often been accepted as *O. heteranthum* Poeppig & Endl., a species based on a Peruvian type (w) that has roots of larger diameter, inflorescences usually with two flowers per branch, and larger aborted flowers with obovate tepals. Most of the Ecuadorian specimens at SEL may be *O. bryolophotum* rather than *O. heteranthum* as labeled, but two specimens from Bolivia and Peru show root and inflorescence features consistent with the latter.

All living and preserved plants that we have seen from Costa Rica represent a single species that corresponds with *O. bryolophotum* and overdescribed by Fritz Kraenzlin and Rudolf Schlechter. Both *O. megalous* Schltr. and *M. asparagoides* Kraenzl. are straightforward *O. bryolophotum* Rchb. f. The type of *O. microphyton* Kraenzl. is a plant less than 10 cm tall with a few aborted flowers and a single fertile flower showing the characteristic lip shape of *O. bryolophotum*.

Oncidium cariniferum (Rchb. f.) Beer, Pract. Stud. Fam. Orch. 283. 1854. *Odontoglossum cariniferum* Rchb. f., Bot. Zeitung (Berlin) 10: 638. 1852. TYPE: Middle America. Figure 36A.

Plant a caespitose epiphyte. Rhizome short; roots 1–2

mm in diameter. **Pseudobulbs** sulcate, ovoid, 7–12 cm long, 4–6 cm wide, subtended by 2–4 foliaceous bracts when young, apex 2-foliate. **Leaves** coriaceous, carinate abaxially, elliptic-lanceolate, 15–40 cm long, 3–6 cm wide, base conduplicate, apex acute. **Inflorescence** a lateral panicle, 50–100 cm long including the scape; branches primary, 13–20 cm long; ovary with pedicel 2–3 cm long. **Flowers** 6–10 per branch, about 4 cm high, 2 cm broad; tepals greenish yellow spotted with reddish brown; lip white aging yellow, callus clear wine red, column white spotted with reddish brown. **Sepals** free, subequal, elliptic-lanceolate, acuminate; dorsal erect, carinate externally, 2.4–2.5 cm long, 6 mm wide; laterals subfalcate, strongly thickened and carinate apically, 2.4–2.6 cm long, 4–5 mm wide. **Petals** similar to the dorsal sepal, elliptic-lanceolate, carinate, apiculate, 2.4–2.5 cm long, 5–6 mm wide. **Lip** anchor-shaped, 1.8–2 cm long, 2.1–2.3 cm wide with conspicuous claw at the base, the blade reniform, shallowly emarginate, and apiculate; callus fleshy, elevated, with 2 high, short, lateral keels at the base, a low central keel, and a pair of ascending teeth in front. **Column** stout, a bit sigmoid in profile, about 1 cm long, broadened at the base, with 2 ascending projections below the stigma; pollinia 2, obovate, with prominent stipe and viscidium.

Epiphytic and uncommon on the larger branches of premontane and lower montane forests at 1000–2000 m. Flowering September to February. Costa Rica and Panama; doubtfully reported from Colombia and Venezuela.

The species is easily recognized by the white, anchor-shaped lip and chocolate brown tepals. The callus suggests a relationship with *Odontoglossum*, and we note the angle between the column and lip would also if the column were not reflexed at the base.

***Oncidium carthagenense* (Jacq.) Sw., Kongl. Vetensk. Acad. Nya Handl. 21:240. 1800. *Epidendrum carthagenense* Jacq. Select. Stirp. Amer. 228, t. 133, fig. 4. 1763. Figure 35D.**

Plant epiphytic, caespitose with few shoots. Rhizome short; roots 2 mm in diameter. **Pseudobulbs** nearly obsolete, about 1 cm long, 1 cm wide, concealed when young by bracts, apically 1-foliate. **Leaves** coriaceous to fleshy, elliptic, sharply keeled abaxially, conduplicate at the base, apically acute, 20–30 cm long, 6–8 cm wide. **Inflorescence** usually pendent, a lateral panicle 75–125 cm long including the scape, the nodes with triangular bracts; ovary with pedicel 1.5–2.5 cm long. **Flowers** with sepals and petals cream spotted with maroon-brown; 1.8–2.2 cm in diameter. **Sepals** similar, reflexed and unguiculate; blades concave, suborbicular, 9–12 mm long, 6–8 mm wide, obtuse, the margins undulate. **Petals** similar to the sepals but broader, 1.2–1.4 cm long, 7–9 mm wide, the margin strongly undulate. **Lip** 3-lobate, subpandurate, constricted on the upper half, 1.2–1.4 cm long, 8–10 mm wide; midlobe, reniform; lateral lobes somewhat fleshy with revolute margins; basal callus consisting of 4 fleshy tubercles, 2 near the base sepa-

rated by a central furrow and 2 near the middle. **Column** 2 mm long, with a pair of 2-lobate wings apically; anther papillose; pollinia 2, rounded, sulcate, with viscidium and short stipe.

Epiphytic in humid but seasonally dry forests at 300–1100 m on trunks and large branches. Flowering June to August. Reported from Florida, West Indies, Central America, and much of tropical South America. The range may depend ultimately on the synonymies accepted.

Oncidium carthagenense is easily recognized in Costa Rica by the white maroon-spotted flowers, the relatively small, inconspicuous pseudobulb, and the large, fleshy leaves, after which it has earned the common name *orejas de burro*. Extensive synonymies published by authors reflect much variation over the range.

***Oncidium cebolleta* (Jacq.) Sw., Kongl. Vetensk. Acad. Nya Handl. 21:240. 1800. *Epidendrum cebolleta* Jacq., Enum. Pl. Carib. 30. 1760. TYPE: Colombia, Cartajena. Figure 35C.**

Plant an erect or pendent, caespitose epiphyte. Rhizome short; roots 1.5–2 mm in diameter. **Pseudobulbs** globose, 1-foliate, 8–10 mm high and wide, mostly concealed by bracts. **Leaves** terete, canaliculate, green or spotted with reddish brown, apex acute, 26–40 cm long, 8–15 mm wide. **Inflorescence** a lateral panicle 25–40 cm long including the scape; ovary and pedicel 1–1.5 cm long. **Flowers** 1.9–2.2 cm tall, 1.4–1.7 cm wide; tepals greenish spotted with reddish brown; lip yellow with callus marked brown. **Sepals** similar, obovate, concave, obtuse and apiculate, 7–8 mm long, 4.5–5.5 mm wide. **Petals** spatulate with undulate margins, obtuse and apiculate, 8–9 mm long, 3.5–4.5 mm wide. **Lip** 3-lobate, pandurate, 1.3–1.5 cm long, 1.4–1.7 cm wide, with crenulate margins; lateral lobes suborbicular to obovate, obtuse or rounded, 5–8 mm long, 3–4 mm wide; midlobe emarginate; callus consisting of a large nose-shaped central keel and 2 lateral teeth. **Column** 3–4 mm long, with a pair of 2-lobate wings; anther papillose; pollinia 2, waxy, with conspicuous oblanceolate stipe and viscidium.

Epiphytic on larger branches and widespread in seasonally dry forests below 600 m. Flowering late December to March. Reported as widespread from Mexico through Central and South America.

Of the three species of terete-leaved oncidiums recognized in Costa Rica, *O. cebolleta* has the largest flower. It is most similar to *O. teres* Ames & C. Schweinf., but the column wings are 2-lobate, and the callus includes a pair of teeth flanking the central keel.

***Oncidium cheiroporum* Rchb. f., Bot. Zeitung (Berlin) 10:695. 1852. TYPE: Panama, Volcán,**

Warszewicz (holotype: w, photo seen). *Oncidium dielsianum* Kraenzl., Pflanzenr. IV. 50 (Heft 80):197, t. 198F. 1922. TYPE: Costa Rica, *Endres* (holotype: w, photo seen). *Oncidium macrohynchum* Kraenzl., l.c.:200, t. 198J. 1922. TYPE: Costa Rica, San Juan de Candelaria, *Endres* (holotype: w, photo seen). *Oncidium cheiroporum* var. *exauriculatum* Hamer & Garay, Las Orquídeas de El Salvador 2:176. 1975. TYPE: Costa Rica, Guanacaste, Tilarán, *Standley & Valerio 46266* (holotype: AMES; Isotype: US). *Oncidium exauriculatum* (Hamer & Garay) R. Jiménez, Orquídea (Méx.) 12:270. 1992. Figure 38C.

REFERENCE—R. Jiménez Machorro, *Oncidium exauriculatum*: Una Orquídea localizada recientemente en México. Orquídea (Méx.) 12:269–276. 1992.

Plant caespitose, sometimes densely so, epiphytic, ≤ 15 cm tall excluding the inflorescence. Rhizome short; roots about 1 mm in diameter. **Pseudobulbs** smooth, green, marked and suffused with brown, pyriform to suborbicular, somewhat compressed, apically 1-foliate, 1.5–3.5 cm tall, 1.5–2.5 cm wide, subtended by 2–3 foliaceous bracts. **Leaves** thin, 5–15 cm long, 5–14 mm wide, elliptic-lanceolate, shortly petiolate and conduplicate at the base, apically acute, with a prominent abaxial keel. **Inflorescence** a lateral panicle, 10–25 cm long, including the scape; ovary and pedicel 6–9 mm long. **Flowers** greenish yellow, 1–1.5 cm across. **Sepals** dissimilar, unguiculate, 5–6 mm long, 4–5 mm wide; dorsal erect, obovate, strongly concave, obtuse, apiculate; lateral sepals shortly connate, reflexed, subquadrate, retuse. **Petals** shortly unguiculate, reflexed, ovate, obtuse, apiculate, 5–6 mm long, 4–5 mm wide. **Lip** adnate to the base of the column, strongly 3-lobate, with a pair of fleshy glands at the base, 1.1–1.2 cm long, 1.2–1.4 cm wide; lateral lobes subquadrate, lightly incurved, rounded; midlobe reniform, emarginate, the margins lightly undulate; callus complex below the isthmus, fleshy, cruciform. **Column** 2–3 mm long, with a pair of broad, subquadrate, correct wings or wings lacking (var. *exauriculatum*); anther terminal, much elongate; pollinia 2, with conspicuous, slender stipe ca. 3 mm long and viscidium. **Capsules** ellipsoid, with beak and persistent flower, 1.5–1.6 cm long; pedicel 8–10 mm long.

Epiphytic in open canopies, usually on larger branches, in premontane and lower montane forests at 600–1700 m. Flowering October to February (var. *cheiroporum*, mostly October to December; var. *exauriculatum*, mostly January and February). Reported from Mexico to Colombia.

This species is easily recognized out of flower by the pyriform pseudobulbs lightly stained with brown. The waxy yellow flowers with cruciform callus are distinctive when plants are in flower.

We accept *O. exauriculatum*, based on the lack of conspicuous column wings, as a geographic variety of *O. cheiroporum*. Some herbarium specimens in Costa Rica show intermediate column wings. We note, however, that specimens from about central Costa Rica northward mostly lack the wings, occur at lower elevations (600–1450 m), and flower in late December to February, while *O. cheiroporum* occurs at 1000–1700 m and flowers from October to December and rarely in January. R. Jiménez Machorro reports that one in 10 flowers of Mexican var. *exauriculatum* produce fruits through self-pollination.

Oncidium cristagalli Rchb. f., Bot. Zeitung 10: 697. 1852. TYPE: Mexico, Oaxaca, *Galeotti 5289* (holotype: w, photo seen). *Oncidium decipiens* Lindl., Fol. Orch. *Oncidium* 22. 1855. TYPE: Mexico, Oaxaca, *Galeotti 5289*. Figure 37B.

Plant epiphytic, caespitose, 6–10 cm high. Rhizome short; roots 1 mm in diameter. **Pseudobulbs** elliptic-ovoid, compressed, 5–15 mm long, 5 mm wide, subtended by 5–8 foliaceous bracts; apex 1-foliate, or leaf aborted. **Leaf** thin, without articulation, linear-lanceolate, somewhat carinate beneath, 2–5 cm long, 6–12 mm wide. **Inflorescence** a lateral raceme of 3–4 somewhat successively borne flowers held just above the leaves; ovary with pedicel 4–8 mm long. **Flowers** 1.8–3 cm tall, 1.5–2.5 cm wide, yellow; petals and lip base spotted with brown. **Sepals** dissimilar; dorsal erect, concave, ovate, ca. 5 mm long, 3 mm wide; lateral sepals shortly connate, ca. 5 mm long, 2 mm wide. **Petals** similar to the dorsal sepal, ovate to subquadrate, 5–7 mm long, 4–5 mm wide, acute. **Lip** deeply 3-lobate, 1.6–2 cm long, 1.4–1.7 cm wide, 5–7 mm across the isthmus, with somewhat crenulate margins; lateral lobes obovate 5–8 mm long, 3–5 mm wide; midlobe deeply emarginate, 4-lobate; callus below the isthmus complex, with a more or less A-shaped, raised, bifid lamina in front. **Column** stout, ca. 4 mm long, with a conspicuous, broad pair of wings in front; anther shortly beaked; pollinia 2 supported on viscidium and oblancoolate stipe. **Capsule** elliptic-obovoid, ca. 1 cm long; pedicel 5 mm long.

Epiphytic in premontane rain forests, often on vines at 400–1100 m; reported to 1850 m. Flowering mostly July to January, but also sporadically throughout the year. Reported from Mexico to Peru.

The small plant with nonarticulate, nonequitant leaves and usually aborted leaf at the pseudobulb apex readily distinguishes this species in Costa Rica. It resembles *Psymorchis pusilla* (L.) Dodson & Dressler in the flower and general habit, but the nonequitant leaves and the presence of a pseudobulb readily separate it from that species.

Plants from Costa Rica southward seem to have more strongly spotted petals than those from Mexico to Nicaragua.

Oncidium dichromaticum Rehb. f., Bonplandia 3:215. 1855. TYPE: New Granada(?), Booth (holotype: w, photo seen). *Oncidium cabagrae* Schltr., Repert. Spec. Nov. Regni Veg. 9:292. 1911. TYPE: Costa Rica, "Cabagra bei Buenos Aires," Pittier 6589 (drawing of type: AMES). *Oncidium rechingerianum* Kraenzl., Pflanzenr. IV, 50(Heft 80):202, t. 18. 1922. TYPE: Costa Rica, Endres (holotype: w; Photo of type: AMES). *Oncidium castaneum* Rehb. f. ex Kraenzl., Pflanzenr. IV, 50(Heft 80):278. 1922. TYPE: Costa Rica and Chiriquí, Endres (holotype: w, photo seen). Probably also *Oncidium costaricense* Schltr., Repert. Spec. Nov. Regni Veg. 9:30. 1910. TYPE: Terraba, 2600 m(?), Pittier 3859. Figure 39C.

Plant epiphytic, cespitose. Rhizome short; roots < 1 mm in diameter. **Pseudobulbs** green spotted with dark wine-purple, somewhat laterally flattened, 7.5–12 cm long, 3.5–5.5 cm wide, ovoid to elliptic-oblong, subtended by 2–3 foliaceous sheaths, apically 2-foliolate. **Leaves** oblanceolate, acute, with a prominent midvein, conduplicate at the base, 9–28 cm long, 1.4–3.5 cm wide. **Inflorescence** a lateral, slender, laxly flowered, short-branched panicle 30–80 cm long; ovary and pedicel 1.7–2.5 cm long, subtended by much shorter acute bracts. **Flowers** 1.8–3.3 cm high, 1.5–2.9 cm wide, colors basically of two patterns, yellow with brown markings or white with purple markings. **Sepals** subequal, 7–13 mm long, 4–8 mm wide, elliptic-oblong, the apex lightly recurved, apiculate; lateral sepals somewhat falcate. **Petals** similar to the sepals but larger, 1.2–2 cm long, 5–11 mm wide, margins undulate. **Lip** 3-lobate, pandurate, 1.5–2.3 cm long, 1.6–1.8 cm wide; lateral lobes small; midlobe deeply emarginate; callus at the base variable, usually of 4 teeth, 3 in front. **Column** 4–6 mm long, with dolabriform column wings at the apex, and with a conspicuous fleshy and smooth tabula infrastigmatica; pollinia 2, waxy, with stipe and viscidium. **Capsules** 4 cm long; pedicel 3 cm long.

Epiphytic on small to large branches in tropical evergreen forests at 500–1200 m of the Pacific slope. Often in disturbed forests. Flowering January to June. Costa Rica and Panama.

The variability of flower size and color in *O. dichromaticum* is extreme and at times confusing. Usually the flower is yellow with dense spots of dark brown on the sepals and petals as well as the lip, but rose forms may be frequent (var. *rosea* Hort.), and white flowers can be found. With experience it is recognized by the combination of the 2-foliolate pseudobulbs, lax inflorescence, often

waving in the wind, and the dark sepals and petals.

Oncidium ensatum Lindl., Edwards's Bot. Reg. 28: misc. 17. 1842. Figure 39A. TYPE: Guatemala (not seen). Figure 40C.

Plant a robust, somewhat rhizomatous terrestrial to ca. 60 cm tall excluding the inflorescence. Rhizome short, ≤ 3 cm between pseudobulbs; roots 1–2 mm in diameter. **Pseudobulbs** ellipsoid, pale green, ca. 6–8 cm long, 2.3–3.5 cm wide, subtended by ≥ 4 foliaceous sheaths lacking articulations, apically 2-foliolate. **Leaves** and foliaceous bracts linear-ensiform, conduplicate, carinate, acuminate, nonarticulate, 25–40 cm long, 2.5–4 cm wide. **Inflorescence** lateral, paniculate, arcuate, 1–1.5 m long including the scape; primary branches 6–8 cm long; ovary and pedicel 1.8–2.5 cm long, subtended by a shorter floral bract 5–6 mm long. **Flowers** 2.3–2.8 cm in diameter, yellow, with reddish brown on the sepals, petals, and callus. **Sepals** similar, 1.3–1.5 cm long, 4–6 mm wide, acute; dorsal elliptic-oblong, margins undulate; lateral sepals somewhat larger, oblong, carinate. **Petals** similar to the sepals, oblique, elliptic-oblong, acute, 1.4–1.6 cm long, 3–5 mm wide, margins undulate. **Lip** 3-lobate, subpandurate, 1.2–1.5 cm long, 1.2–1.5 cm across the base, 1.2 cm across the midlobe; lateral lobes rounded, spreading, midlobe emarginate, apiculate, isthmus ca. 6–7 mm wide; callus fleshy, as wide or wider than long, with 7 teeth. **Column** short, 5 mm long, with undulate wings; pollinia 2, waxy.

Terrestrial on embankments in lowland, dry tropical, semideciduous forests at 450–850 m. Flowering March to April. Uncommon from Mexico to Panama.

The usually terrestrial plants with long, ensiform leaves lacking articulations (at least the foliaceous sheaths) and more or less typical flowers of the genus are good diagnostic features for field recognition.

Oncidium globuliferum Kunth, Nov. Gen. & Sp. 1:347. 1815. TYPE: New Granada, "Andium Popayanensium . . ." (?P). *Oncidium globuliferum* var. *costaricense* Rehb. f., Gard. Chron. 1678. 1871. TYPE: Costa Rica, Endres (lectotype selected here: W13212). *Oncidium wercklei* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:68. 1923. New name based on Endres (w 13212). Figure 37A.

Plant an epiphytic vine; apparent rhizome probably a modified, indeterminate inflorescence, with lateral shoots spaced 6–10 cm or more apart. **Pseudobulbs** of lateral shoots suborbicular to elliptic-ovoid, strongly compressed; 1.5–3 cm long, 1.3–2.5 cm wide, subtended by 1–3 foliaceous sheaths; apex 1-foliolate. **Leaves** elliptic-ovate, abaxially carinate, the apical leaf with short

petiole, 5–8 cm long, 1.5–2.5 cm wide; apex acute to obtuse; foliaceous sheaths smaller. Functional **inflorescence** formed in 2 ways, directly on rhizome, with or without an accompanying new shoot, or within a foliaceous sheath at the pseudobulb base; a solitary flower; scapes to about 3 cm long (excluding flower and pedicel); ovary with pedicel 2.5–4.5 cm long, subtended by subulate bract 3–6 mm long. **Flower** large, 2.5–4 cm tall, 2–3 cm wide, brilliant yellow with tepals spotted with brown. **Sepals** dissimilar, shortly unguiculate; dorsal elliptic, acute, apiculate, 1.2–1.5 cm long, 6–7 mm wide; lateral sepals reflexed, oblong-elliptic, acute, 1.3–1.6 cm, 5–6 mm wide. **Petals** oblong-ovate, somewhat constricted centrally, shortly unguiculate, 1.4–1.6 cm long, 5–6 mm wide; margins undulate; apex acute to obtuse. **Lip** strongly 3-lobate, 2–3 cm long, 2.5–3.5 cm wide (midlobe), ca. 1 cm across lateral lobes; isthmus 5–6 mm wide; midlobe deeply emarginate, forming 2 rounded lobes; callus fleshy, with 7–9 teeth. **Column** erect, 8 mm long, with broad wings; anther papillose, pollinia 2, with short stipe and viscidium.

Epiphytic in high canopies of premontane and montane rain forests at 800–1800 m. Flowering only in the brightest part of the canopy January to August. Costa Rica to Ecuador; probably also to Venezuela and perhaps to Bolivia.

The viny habit of *O. globuliferum* is unique to this species, especially since the “rhizome” appears to be a modified inflorescence that produces short vegetative shoots laterally. Nothing is known about the base of the plant.

Reichenbach attempted to recognize the Costa Rican plants with consistently smaller flowers as var. *costaricense*, but specimens from Ecuador exhibit flowers of similar size.

Oncidium isthmi Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:84. 1922. TYPE: Panama, Sambo River, South Darien, 200 m, *Pittier 5569* (drawing of type: AMES). Figure 41B.

Plant a robust, somewhat rhizomatous epiphyte to about 75 cm excluding inflorescence; rhizome short to about 5 cm between pseudobulbs; roots 1–2 mm in diameter, some of them directed upward (trash-basket roots). **Pseudobulbs** large, 9–15 cm long, 3–4.5 cm wide, sulcate, oblong-ovoid, apically 2–3-foliate, covered at the base by 2–4 foliaceous bracts. **Leaves** coriaceous, linear-ligulate, acute, 25–35 (60) cm long, (2)4–5 cm wide; apex acute. **Inflorescence** lateral, paniculate, arcuate or pendulous, to 1.50 m long including the scape, primary branches 8–15 cm long; ovary and pedicel 1.8–2.5 cm long, subtended by bracts 5–6 mm long. **Flowers** 2.3–2.8 cm long, 1.8–2.5 cm wide, yellow, barred with reddish brown on the sepals, petals, and callus. **Sepals** dissimilar; dorsal elliptic-oblong, acute, with undulate margins, 11–12 mm long, 5–7 mm wide; lateral sepals somewhat larger, oblong, acute, 1.2–1.5 cm long, 4–7 mm wide. **Petals** elliptic-oblong, oblique, subacute, with undulate margins, 1.1–1.3 cm long, 4–5 mm wide.

Lip 3-lobate, pandurate, 1.4–1.7 cm long, 9–11 mm across the base, 1.4–2 cm across midlobe; lateral lobes, rounded, extended laterally; midlobe emarginate, apiculate; isthmus narrow, ca. 4 mm wide with strongly recurved margins; callus fleshy, as wide or wider than broad, with 7 teeth. **Column** short, 5 mm long, with serrate, dolabriform wings; pollinia 2, waxy, pyriform, with stipe and viscidium.

Epiphytic on larger branches in lowland tropical semideciduous forests at 450–850 m. Flowering December to April. Southeastern Costa Rica and Panama.

Oncidium isthmi is most similar to *O. polycladum* Rchb. f. ex Lindl. but has longer primary branches in the inflorescence, and the flowers are a more intense yellow. Also, the midlobe of the lip is much larger with, consequently, a more conspicuously narrow isthmus.

Oncidium klotzschianum Rchb. f., Bot. Zeitung (Berlin) 10:695. 1852. TYPE: Chiriquí, Warscewicz (w). *Oncidium obryzatum* Rchb. f., Bonplandia 2:108–109. 1854. TYPE: Peru, Warscewicz (?holotype: w, photo seen). *Oncidium fulgens* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17:83. 1922. TYPE: Panama, Chiriquí, *Powell 157* (lectotype selected here: AMES 23918). *Oncidium angustisepalum* Kraenzl., Pflanzenr. IV. 50(Heft 80):203. 1922. TYPE: Costa Rica, *Endres* (holotype: w, photo seen). *?Oncidium sclerophyllum* Kraenzl., Pflanzenr. IV. 50(Heft 80):204. 1922. TYPE: Costa Rica, San Ramón, *Endres* (w). *Oncidium varians* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:151. 1923. TYPE: Costa Rica, La Palma, A. & C. *Brade 1095*. *Oncidium graciliforme* C. Schweinf., Bot. Mus. Leaflet. 5:96–97. TYPE: Panama, Chiriquí, *Powell 3227* (*Hort. Powell 157*). Figure 39B.

Plant epiphytic, caespitose, forming small clumps to 40 cm tall excluding inflorescence. Rhizome short; roots 0.5–1.5 mm in diameter. **Pseudobulbs** smooth to rugose, usually with purple spots, suborbicular to conic, suffused and marked with dark brown, 3–8.5 cm long, 1.2–4 cm wide, subtended by 3–5 foliaceous bracts, apex 1(2)-foliate. **Leaf** base conduplicate; blade carinate beneath, linear-lanceolate to broadly elliptic, coriaceous, 10–35 cm long, 1.2–6 cm wide, apex acute or subacute. **Inflorescence** an erect or arcuate raceme (when small) or panicle 30–80 cm long including the scape with numerous flowers; ovary and pedicel 1.1–2.5 cm long. **Flowers** variable in size, 2–4 cm high, 1–3.2 cm wide, yellow, segments marked basally with brown. **Sepals** subequal, free, obovate-spatulate, obtuse or truncate, carinate abaxially, 9–15 mm long, 2–7 mm wide. **Petals** broader than sepals, obovate-spatulate, obtuse or trun-

cate, 1–1.5 cm long, 4–12 mm wide. **Lip** 3-lobate, 1–2.5 cm long, 1–2.5 cm wide, midlobe deeply emarginate; isthmus 2–5 mm wide; lateral lobes rounded; callus basal, fleshy, the basal part forming a plate with 4–5 small teeth at the base and 3 larger teeth in the front. **Column** 5–6 mm long, with a pair of apical, porrect, dolabriform wings with serrulate margins; tabula infrastigmatica with 2 fleshy projections; anther beaked; pollinia 2, waxy, rounded, with elongate stipe and viscidium. **Capsules** (only 1 specimen in fruit seen) ellipsoid, ca. 3 cm long with beak; pedicel about 1 cm long.

Common epiphyte in premontane and lower montane rain and cloud forests at 700–1900 m. Flowering throughout the year. Costa Rica to Peru.

The small-flowered forms of *O. klotzschianum* may be distinguished from *O. obryzatoides* Kraenzl. by the larger, paniculate inflorescences and by the color of the tepals, which are spotted with brown rather than stained along the midveins.

The bewildering range in flower size and plant form seems to indicate either extreme variation with expected proliferation of synonyms, or that there are several closely related species here. There appears to be no pattern of size variation according to either horizontal or vertical ranges, nor of phenology. Indeed, marked differences in flower size can be seen in the same herbarium specimen. Of all the synonyms proposed above, only *O. obryzatum* corresponds to the large-flowered forms. The smallest-flowered extremes are represented by the names *O. sclerophyllum* and *O. graciliforme*. In the *Manual* (MO) treatment, Dressler is accepting *O. sclerophyllum* as distinct, although it is known only by the type specimen. A rehydrated flower from the type had broad, spatulate sepals in addition to the petals, but the callus and column were consistent with *O. klotzschianum*.

The plant accepted in Dunsterville and Garay (Venezuelan Orchids Illustrated 6, p. 303) as *O. klotzschianum* exhibits a repent habit, smaller lip in proportion to the tepals, and shorter column wings, features that do not agree with the type from Panama. The illustrated plant may be *O. picturatum* Rchb. f., described from Venezuela but not treated in the six-volume work.

Oncidium luteum Rolfe, Bull. Misc. Inform. 172. 1893. Type locality unknown. *Oncidium pittieri* Schltr., Repert. Spec. Nov. Regni Veg. 9:30. 1910. TYPE: Costa Rica, by La Palma, Pittier 10310 (drawing of type: AMES, photo seen). *Oncidium cheiroporoides* Kraenzl., Pflanzenr. 80:

199, t. 1922. TYPE: Costa Rica, *Endres* (holotype: w, photo seen). Figure 38B.

Plant a stout, caespitose epiphyte 10–35 cm tall excluding inflorescence. Rhizome short; roots ≤ 2 mm in diameter. **Pseudobulb** nearly obsolete, compressed, ≤ 4 cm long, subtended and concealed by 4–6 foliaceous sheaths, apex 1-foliate. **Leaves** arranged in a fan, duplicate, subcoriaceous, narrowly to broadly elliptic, acute, with conspicuous sheath below the articulation, 6–30 cm long, 1.5–6.5 cm wide. **Inflorescences** 1–2 in the foliaceous sheath axils, mostly less than twice the longest leaf, each a panicle with 1–2 or more orders of branching, 15–55 cm tall including the scape; branches fractiflex; ovary with pedicel ca. 1 cm long, subtended by small triangular bracts ≤ 2 mm long. **Flowers** greenish yellow, with brown spot near callus. **Sepals** similar, somewhat concave, oblanceolate-obovate, obtuse, 3–5 mm long, 2–3 mm wide; lateral sepals somewhat reflexed at the base. **Petals** broadly elliptic, obtuse, 4–5 mm long, 2–3 mm wide. **Lip** deeply 3-lobate near the base, about 9–14 mm long, 1–1.2 cm wide; lateral lobes winglike, suborbicular; midlobe broadly cuneate, 4–5 mm wide; isthmus ca. 2 mm wide; callus below the isthmus of 2 lateral and 3 central teeth. **Column** complex and unusual, with a central horn at the base curved upward, with a pair of antrorse hornlike wings at the apex; anther with conspicuous beak; pollinia 2, with long stipe about 2 mm long. **Capsules** ellipsoid, 1.6 cm long including the long beak; pedicel 5–7 mm long.

Epiphytic in windy cloud forests at 1200–2500 m. Flowering October to December. Endemic to Costa Rica.

This rare epiphyte is easily distinguished by the large fan of leaves concealing the pseudobulb. Flowers could be confused with those of *O. cheiroporum* Rchb. f., but the plants are much larger with much broader and longer leaves subtending the nearly obsolete pseudobulb.

Oncidium obryzatoides Kraenzl., Pflanzenr. IV. 50(Heft 80):240. 1922. TYPE: Costa Rica, *Endres* (w). *Oncidium tetraskelidion* Kraenzl., Pflanzenr. IV. 50(Heft 80):259. 1922. *Oncidium brenesii* Schltr., Repert. Spec. Nov. Regni Veg. 19:257–258. 1923. TYPE: Costa Rica, *Brenes* 240 (AMES). ?*Oncidium calyptostalis* Kraenzl., Pflanzenr. IV. 50(Heft 80):260. 1922. TYPE: Costa Rica, *Endres* (w, photo seen). Figure 39A.

Plant a small caespitose epiphyte to 8–25 cm tall; rhizome short; roots to 1.5 mm in diameter. **Pseudobulbs** often with purplish spots, ovoid, sulcate, somewhat compressed laterally, 2.5–5 cm long, 2–3 cm wide; subtended by 2–4 foliaceous bracts; apex 1-foliate. **Leaves** usually distinctly petiolate; blade subcoriaceous, carinate beneath, elliptic-lanceolate, 5–25 cm long, 1–3 cm wide; apex acute, apiculate. **Inflorescence** a lateral raceme or

few-branched panicle, 12–35 cm long; ovary with pedicel 1.7–2.5 cm long. **Flowers** variable, 1.5–3 cm high, greenish yellow; tepals stained with brown along midvein; lip brown around the callus. **Sepals** similar, shortly unguiculate, obovate to spatulate, 10–12 mm long, 4–5 mm wide; apex obtuse to rounded, apiculate, carinate abaxially; lateral sepals sometimes reflexed. **Petals** similar to the sepals, somewhat constricted centrally, 10–12 mm long, 5–6 mm wide; apex obtuse to rounded, apiculate. **Lip** deeply 3-lobate at the base, 10–17 mm long, 6–16 mm across the subtriangular lateral lobes; midlobe deeply emarginate, forming an isthmus 3–5 mm wide; callus fleshy between lateral lobes, with broad projection centrally, 2 blunt lateral teeth centrally, 2 similar teeth in front. **Column** complex, 8 mm long; tabula infrastigmatica with prominent lateral margins, apical wings subtriangular with crenulate margins; pollinia 2, round, supported on an oblongate stipe and viscidium. **Capsules** ellipsoid, ca. 4 cm long including elongate beak; pedicel 2–2.5 cm long.

Epiphytic on larger branches of cloud forests at 1050–1900 m. Flowering September to February. Endemic to Costa Rica from the south side of the Central Valley to the Monteverde area.

Oncidium obryzatoides is distinguished by the inflorescence, which has few branches, each with few greenish yellow flowers with centrally brown-stained tepals. The similar *O. klotzschianum* Rchb. f. has tepals distinctly spotted with brown and often larger, deeper-yellow flowers. Hybrids possibly exist between the two species.

Oncidium fulgens Schltr. and *O. varians* Schltr. have been considered as synonyms of *O. obryzatoides* (Bot. Mus. Leaflet 6:6–7. 1938), and their types have similarly small flowers. However, the types of *O. fulgens* and *O. varians* have broader brown-spotted petals consistent with small forms of *O. klotzschianum* Rchb. f. (synonym, *O. obryzatum* Rchb. f.) rather than the narrower petals stained with brown along the midvein as in *O. obryzatoides*.

***Oncidium ochmatochilum* Rchb. f., Bot. Zeitung (Berlin) 10:698. 1852. TYPE:** Probably Chiriquí, Panama, Warszewicz s.n. (w). **?*Oncidium chelidon* Kraenzl., Pflanzenr. IV. 50(Heft 80): 216–217. 1922. TYPE:** Locality unknown, Wallis. ***Oncidium chelidonizon* Kraenzl., Pflanzenr. IV. 50(Heft 80):217. 1922. TYPE:** Costa Rica, Endres s.n. (w).

Plant a large, caespitose epiphyte to nearly 1 m without inflorescence; rhizome short, roots 2–4 mm in diameter. **Pseudobulbs** little compressed laterally, rugose, ovoid to lanceolate, 10–15 cm long, 3.5–5 cm wide; subtended by 6–10 foliaceous sheaths; apex usually 2(rarely 1)-foliate, somewhat attenuate. **Leaves** conduplicate at the base, the blade linear-ensiform, with raised

veins abaxially, 40–60 cm long, 3–5 cm wide; apex acute. **Inflorescence** lateral, paniculate, to about 3 m long including the scape; branches fractiflex; ovary with pedicel, 3–4 cm long, subtended by a short, triangular bracts ca. 2 mm long. **Flowers** with tepals greenish with reddish brown spots, apices greenish; lip white with yellow callus, with an orange spot at the base and purple spots at and below the isthmus. **Sepals** similar, free, reflexed, abaxially carinate, linear-lanceolate, 1.5–1.6 cm long, 3–4 mm wide; apices acute, apiculate; lateral sepals reflexed. **Petals** reflexed, elliptic ovate to lanceolate, carinate abaxially, 1.3–1.5 cm long, 5–7 mm wide; apex acute, apiculate; margins undulate. **Lip** 3-lobate, 1.2–1.4 cm long, 1–1.2 cm wide; lateral lobes rounded, ca. 5 mm long, 3 mm wide; midlobe anchor-shaped, apiculate, not undulate; isthmus ca. 5 mm wide; callus on lower half, fleshy, with 7 teeth, 4 teeth laterally and 3 apically. **Column** stout, 6 mm long, with conspicuous tabula infrastigmatica, without wings; pollinia 2, supported on an elongate stipe and viscidium.

Low-density epiphyte in evergreen forests on larger branches at 800–1400 m; usually seen as single plants. Flowering April to August. Costa Rica and Panama; reported from Guatemala to Nicaragua and Andean South America.

Oncidium ochmatochilum is easily distinguished by the growth habit, with several long leaves subtending the pseudobulbs, and the long inflorescence sometimes exceeding 2 m. Vegetatively, it is similar to *O. panduriforme* Ames & C. Schweinf., a species with shorter inflorescences and somewhat smaller, less complex flowers.

Oncidium cardiochilum Lindl. (1855) may be the South American equivalent of *O. ochmatochilum*.

***Oncidium panduriforme* Ames & C. Schweinf., Sched. Orch. 8:77–78. 1925. TYPE:** Costa Rica, Cachi, Alfaro (holotype: US, photo seen). Figure 36C.

Plant epiphytic, caespitose, forming small clumps to about 50 cm excluding inflorescence. Rhizome short; roots flexuous, 3–4 mm in diameter. **Pseudobulbs** ovoid, 6–10 cm long, 3–5 cm wide, apically 1–2-foliate, concealed when young by 6–8 foliaceous sheaths. **Leaves** elliptic-lanceolate, acute, coriaceous, with raised veins abaxially, base conduplicate, 10–40 cm long, 3–5 cm wide. **Inflorescence** lateral, paniculate 40–80 cm long including the scape, arcuate, branches short, fractiflex; ovary and pedicel 1.5–2.5 cm long. **Flowers** 2–2.2 cm long, 1.7–1.9 cm wide; tepals yellowish lightly spotted with brown; lip white turning yellow. **Sepals** subequal, elliptic-lanceolate, acuminate, abaxially carinate, 10–12 mm long, 3–4 mm wide; dorsal erect; lateral sepals lightly falcate and reflexed. **Petals** similar to the sepals but broader, 10–12 mm long, 3.4–4.5 mm wide. **Lip** pandurate, 3-lobate, 10–12 mm long, 8–9 mm wide, isthmus broad, about 5–6 mm wide; lateral lobes small, subquadrate; midlobe reniform, emarginate, apiculate;

disk with a fleshy, obscurely 3-dentate, platelike callus basally. **Column** erect, without wings, 6–8 mm long; tabula infrastigmatica with 2 fleshy, elevated, antrorse borders; pollinia 2, waxy, rounded, with conspicuous stipe and viscidium.

Rare epiphyte of high canopies of premontane and lower montane cloud forests at 1400–1800 (2500) m. Flowering July to November. Costa Rica; also reported from Panama.

Oncidium panduriforme is nearly identical in habit to *O. ochmatochilum* Rchb. f., a species with somewhat larger pseudobulbs, longer inflorescences, and larger, more complex flowers.

***Oncidium parviflorum* L. O. Williams, Amer. Orchid Soc. Bull. 11:32–33, 1942. TYPE:** Panama, Province of Coclé, region north of El Valle de Antón, *Allen 2937* (AMES). Figure 39D.

Plant a caespitose epiphyte to about 40 cm tall; rhizome short; roots ≤ 2 mm in diameter. **Pseudobulbs** spotted with purple, elliptic to ovoid, compressed, sulcate, 8–12 cm long, 3–4 cm wide, subtended by 3–4 foliaceous bracts; apex 1-foliate. **Leaves** petiolate; blades coriaceous, carinate beneath, linear lanceolate, 15–40 cm long, 2–3 cm wide; apex acute, somewhat asymmetric. **Inflorescence** lateral, paniculate, 75–100 cm long, with short, compact, fractiflex primary branches 1–2 cm long; ovary with pedicel ca. 6 mm long, subtended by a subulate bract 3–4 mm long. **Flowers** spreading, 1.3–1.5 cm tall; tepals brown with yellow apices; lip with yellow lobes, area around callus and isthmus brown. **Sepals** dissimilar, distinctly unguiculate, with undulate margins; dorsal obovate to spatulate, somewhat keeled abaxially 5–6 mm long, 2–3 mm wide, obtuse, apiculate; lateral sepals elliptic, falcate, with prominent keel abaxially, 6–7 mm long, 2–3 mm wide, acute. **Petals** similar to the dorsal sepal, unguiculate, spatulate, 5–6 mm long, 3–4 mm wide; apex acute to obtuse, apiculate. **Lip** 3-lobate from the base, 9–12 mm long, 6–7 mm wide across lateral lobes, 4–5 mm across midlobe; lateral lobes rounded; midlobe deeply emarginate; isthmus ca. 3 mm wide; callus between lateral lobes fleshy, minutely pubescent, with 2 lateral and 2 apical teeth. **Column** 2–3 mm long, with a pair of rounded, correct, acute column wings; anther with short beak; pollinia 2, obovoid, with viscidium and elongate stipe. **Capsules** unknown.

Epiphytic and apparently rare in premontane rain forests at 800–1000 m. Flowering in Costa Rica May and June; in Panama, February and March. Northern Costa Rica to Central Panama.

Oncidium parviflorum is easily recognized by the purple-spotted pseudobulbs, elongate inflorescence with very short branches, and the small flowers.

Flowers of Costa Rican plants differ somewhat from the type in the more slender lateral sepals,

the broader midlobe, and the markedly less pubescent callus. Otherwise, the plant habit, with long, slender inflorescence, the color pattern of the flowers, and the large, semilunate column wings provide a very good match for *O. parviflorum*. The above description is based on Costa Rican material.

***Oncidium polycladium* Rchb. f. ex Lindl., Fol. Orch. 6(7):47, 1855. TYPE:** Costa Rica (probably Panama in modern times), Veragua Chiriquí, *Warszewicz* (holotype: κ ; isotype: w). Probably *Oncidium guttulatatum* Rchb. f. ex Lindl. TYPE: Locality unknown, from garden at Herrenhausen (κ). *Oncidium tonduzii* Schltr., Repert. Spec. Nov. Regni Veg. 9:31, 1910. TYPE: Costa Rica, Santo Domingo de Golfe Dulce, *A. Tonduz 9891* (isotype: us ; drawing of type: AMES). ?*Oncidium peliograma* Linden & Rchb. f., Gard. Chron. 1451, 1871. TYPE: Chiriquí, *Wallis*. Figure 41A.

Plant epiphytic, caespitose to ca. 50 cm high; rhizome short; roots ≤ 2.5 mm in diameter. **Pseudobulbs** ovate, sulcate, compressed, 7–15 cm long, 1.5–4 cm wide; apex (1)2–3-foliate, subtended by 5–6 foliaceous, soon deciduous bracts. **Leaves** subcoriaceous, abaxially carinate, 35–50 cm long, 1.5–6 cm wide, base conduplicate, apex acute. **Inflorescence** paniculate, ≤ 1 m long including scape; primary branches somewhat fractiflex, 2–12 cm long; ovary with pedicel 1.5–2 cm long subtended by a subulate bract about 7 mm long. **Flowers** 2–2.7 cm high, yellow, bases of tepals and lip with brown bands. **Sepals** dissimilar, distinctly unguiculate, with undulate margins; dorsal obovate to ovate, obtuse, apiculate, 9–11 mm long, 4 mm wide; lateral sepals elliptic-oblong, falcate, 11–13 mm long; 3–4 mm wide. **Petals** shortly unguiculate, elliptic to subspatulate, 8–10 mm long, 4–5 mm wide; margins undulate; apex obtuse. **Lip** 3-lobate from the base, 9–13 mm long, 6–8 mm wide across the base, 8–13 mm wide across midlobe; lateral lobes small, rounded; midlobe reniform, emarginate; isthmus 3–4 mm wide when spread; callus fleshy, narrower than long, with about 7 rounded teeth, 3 apical and 4 lateral, the central tooth largest and obliquely truncate. **Column** 4–5 mm long; tabula infrastigmatica with enlarged lateral margins; column wings dolabriform; anther without beak; pollinia 2, with stipe and viscidium. **Capsules** ellipsoid, 5 cm long including short beak; pedicel 1 cm.

Epiphytic usually in crotches between larger branches of trees in semideciduous forests at 0–1000 m on the Pacific slope. Flowering late January to April. Costa Rica and probably Panama.

Oncidium polycladium has been synonymized with related *O. baueri* Lindl. from South America. However, that species has a more sharply toothed callus, narrower column wings, and a distinctly beaked anther. It is easily distinguished from *O.*

isthmi Schltr. only with experience. In aspect, the isthmus of *O. isthmi* is comparatively much narrower, and the branches of the inflorescence are statistically longer.

The original description of *O. guttulatatum* mentions neither origin nor collector, but a recent analysis of the flower shows the characteristic lip that is longer than the lateral sepals and the callus of *O. polycladium*.

Oncidium schroederianum (O'Brien) Garay & Stacey, *Bradea* 1:408. 1974. *Odontoglossum schroederianum* Rchb. f., nom. illeg. (not Rchb. f. 1882), *Gard. Chron.* 3,2:364. 1887. TYPE: *Schroeder* (holotype: w, photo seen). *Miltonia schroederiana* O'Brien, *Gard. Chron.* (2):210. 1889. *Odontoglossum confusum* Garay (nom. nov.), *Orchidee* (Hamburg) 13:217. 1962. *Miltonioides confusa* (Garay) Brieger & Lückel, *Orchidee* (Hamburg) 34(4):131. 1983. Figure 35E.

Plant epiphytic, caespitose. Rhizome short; roots 2 mm in diameter. **Pseudobulbs** elliptic-oblong, coarsely sulcate, 5.5–10 cm long, 2–4 cm wide, apically 1–3-foliate, subtended when young by 4–6 foliaceous bracts. **Leaves** subcoriaceous, abaxially carinate, conduplicate at the base, acute, 10–40 cm long, 2.5–5 cm wide. **Inflorescence** a several-flowered raceme, rarely a panicle with 1–2 branches, erect or arcuate, 20–30 cm long including the scape; ovary and pedicel 2.5–3 cm long subtended by a much shorter, triangular bract. **Flowers** 5–6.3 cm tall, 2.8–3.3 cm wide; tepals yellowish barred with chocolate brown, yellow-tipped; lip white turning yellow with age, tinted rose basally. **Sepals** free, similar, linear-lanceolate, acuminate; dorsal 2.5–3.2 cm long, 5–8 mm wide; lateral sepals lightly inflexed, 3.2–3.7 cm long, 5–8 mm wide. **Petals** falcate, acuminate, curved upward, 2.2–3.2 cm long, 9–12 mm wide. **Lip** simple, 2.8–3.2 cm long, 2.4–2.6 cm wide, united firmly to the column base, with a single broadened reniform apical lobe; disk with a fleshy elevated callus of 3 keels, the middle keel bifid apically. **Column** short, 9 mm long, with fleshy tabula infrastigmatica; pollinia 2, with stipe and conspicuous viscidium.

Epiphytic in premontane cloud forests at 900–1800 m. Flowering July to October. Costa Rica and Panama.

Oncidium schroederianum is easily recognized by the chocolate-barred tepals and large, simple, white lip stained with rose at the base.

Oncidium stenobulbon Kraenzl., *Pflanzenr.* IV. 50(Heft 80):281. 1922. TYPE: Costa Rica, *Endres* (holotype: w, photo seen). *Oncidium naranjense* Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 19:259. 1923. TYPE: Costa Rica, Cerro

del Espíritu Santo a Naranjo de Alajuela, *Brenes* 22 (lectotype selected here: AMES). Figure 40B.

Plant caespitose, epiphytic, yellowish green. Rhizome short; roots white, 1–2 mm in diameter. **Pseudobulbs** elliptic-ovoid to suborbicular, strongly flattened laterally, 3.5–12 cm long, 3.5–5 cm wide, furrowed when dry, the base covered by 2–4 imbricate, foliaceous bracts. **Leaves** sessile to short petiolate, strongly carinate abaxially, 1–2(3) at the pseudobulb apex; blade elliptic to obovate, obtuse, coriaceous, conduplicate at the base, 4–15 cm long, 2.5–5.5 cm wide. **Inflorescences** lateral, 1–2 at the base of the shoot, an erect or arcuate panicle, exceeding the leaves, 50–80 cm long; branches zigzag, 2–10 cm long, with 1–5 flowers; ovary with pedicel 1.5–2.5 cm long. **Flowers** yellow, 2.5–3 cm in diameter; tepals spotted with light brown, apices yellow; lip yellow with brown on isthmus. **Sepals** dissimilar, free with undulate margins, elliptic-ovate, with claw at the base; dorsal erect, 1.1–1.2 mm long, 1–2 mm wide; lateral sepals reflexed with longer claw, subfalcate, 1.4–1.5 cm long, 2–3 mm wide. **Petals** broader than the sepals, with short claw, elliptic-ovate to lanceolate, 1–1.2 cm long, 5–6 mm wide. **Lip** 3-lobate, 1.4–1.7 cm long, 1–1.5 cm wide; lateral lobes, rounded, 5–7 mm long, 4–5 mm wide; midlobe emarginate, apiculate, with undulate margin; isthmus ca. 5 mm wide; callus fleshy, consisting of 7 teeth, 5 in one plane, 2 lower at the apex. **Column** short, 5–6 mm long, with tabula infrastigmatica; column wings somewhat rounded, the margins entire; pollinia 2, obovate, with prominent stipe and viscidium.

Uncommon epiphyte in deciduous forests at 800–1050 m elev. Flowering November to December; April and June. Apparently endemic to Costa Rica.

Oncidium stenobulbon closely resembles *O. ansiferum* Rchb. f., a species with plants less yellow-green, usually more elongate leaves, hatchet-shaped column wings, and, most notably, nearly solid, dark brown tepals. *Oncidium ansiferum* is known mostly above 1350 m. See additional notes under that species.

Oncidium stenoglossum (Schltr.) Dressler & N. H. Williams, *Orquidea* (Méx.) 4:339. 1975. *Miltonia stenoglossa* Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 19:66. 1923. TYPE: Costa Rica, *Tonduz* 31. *Odontoglossum stenoglossum* (Schltr.) L. O. Williams, *Lloydia* 10:212. 1947. *Miltonioides stenoglossa* (Schltr.) Brieger & Lückel, *Orchidee* (Hamburg) 34:131. 1983. Figure 36B.

Plant a caespitose epiphyte; rhizome short; roots to 2 mm in diameter. **Pseudobulbs** ovate, sulcate, 5–9 cm long, 2.5–3.5 cm wide; subtended by 3–4 foliaceous bracts; apex 1–2 foliate. **Leaves** coriaceous, conduplicate

cate, elliptic to oblong, 15–35 cm long, 2.2–3.3 cm wide; apex bluntly acute, apiculate. **Inflorescence** lateral, arcuate, paniculate (Costa Rican plants), 50–80 cm long, laxly flowered; scape with short bracts and conspicuous nodes; primary branches 6–15 cm long; ovary with pedicel 1–2 cm long, subtended by triangular ovate bracts 4–6 mm long. **Flowers** with tepals yellowish barred with dark green to brown; lip white turning yellow, with purple band(s) on lower $\frac{1}{3}$. **Sepals** similar, elliptic oblanceolate, 1.5–1.9 cm long, 5–7 mm wide; apex carinate abaxially, acute; lateral sepals close forming an acute angle. **Petals** similar to the sepals, oblanceolate, subfalcate, curved upward, 1.6–2 cm, 5–6 mm wide; apex recurved, acute. **Lip** simple, 1.6–1.7 cm long, 5–7 mm wide; base canaliculate clasping the column; apex dilated, fleshy, abaxially carinate; callus essentially absent, base with obscurely thickened nerves. **Column** stout, 4 mm long; with narrow, undulate wings; pollinia 2, with elongate stipe and viscidium. **Capsules** ellipsoid, 2 cm long, pedicel 1 cm long.

Epiphytic on larger branches in humid, shady, cloud forests at 1400–2000 m. Flowering May to December. Costa Rica and Panama; also reported from Mexico to Nicaragua, but may be confused with other species. Plants in cultivation often produce fruit, suggesting autogamy, which might explain differences seen in different regions.

We are fortunate that the basionym *Miltonia stenoglossa* Schltr. is Costa Rican, because we cannot verify heterotypic synonyms suggested by others. The basionym *Odontoglossum leucomelas* Rchb. f. (1864) from Mexico is much more strongly colored, but is otherwise similar to the Costa Rican plant. The basionym *Odontoglossum pauciflorum* L. O. Williams (1954) is probably synonymous, although the type is from Honduras.

Oncidium stenotis Rchb. f., *Linnaea* 41:67. 1877. TYPE: Costa Rica, *Low* (holotype: w, photo seen). *Oncidium turialbae* Schltr., *Repert. Spec. Nov.* 9:32. 1911. TYPE: Costa Rica, Turialba, *Biolley* (or *Pittier*?) 8423 (drawing of type: AMES; ?isotype: *Pittier* 8423, US). Figure 40D.

Plant epiphytic, somewhat climbing; rhizome distinct; roots much branched, 1–2 mm in diameter. **Pseudobulbs** elliptic oblong, 8–15 cm long, 3–5 cm wide, somewhat compressed laterally, ancipitous, coarsely sulcate, subtended by 3–6 foliaceous bracts, apex 1-foliate. **Leaves** petiolate, elliptic-oblong, subcoriaceous, base conduplicate, strongly carinate abaxially, 20–60 cm long, 2–6 cm wide, apex obtuse to rounded, apiculate. **Inflorescence** lateral, paniculate, 1–1.5 m long with primary branches \leq 12 cm long; ovary with pedicel 2.5–4 cm long. **Flowers** numerous, 2–3.5 cm in diameter, usually dull yellow spotted with brown, lip bright yellow marked at and below the isthmus with brown. **Sepals**

free, elliptic-lanceolate, apiculate, the margins crenulate; dorsal 1.3–1.7 cm long, 5–7 mm wide; lateral sepals unguiculate, strongly carinate abaxially, 1.7–2.2 cm long, 4–7 mm wide. **Petals** similar to dorsal sepal, parallel with lateral sepals, elliptic-lanceolate, 1.3–1.7 cm long, 5–7 mm wide, margins crenulate; apex falcate, apiculate. **Lip** 3-lobate, 1.3–1.6 cm long and wide; lateral lobes suborbicular; midlobe reniform, emarginate, apiculate, margins undulate; isthmus 3–4 mm wide, less than $\frac{1}{3}$ the width of the lip; callus fleshy, with 4–6 teeth at the base and 3 at the apex. **Column** 5–7 mm long, with tabula infrastigmatica, with a pair of narrow, dentate, apical wings; pollinia 2, with elongate stipe and viscidium.

Epiphytic in lowland and premontane rain forests of the Atlantic slope at 50–1300 m. Flowering mostly September to December; rarely to April. Reported from Honduras to Ecuador; perhaps also Peru.

Oncidium stenotis is distinguished by the broad apical leaf on relatively large, sulcate pseudobulbs, the elongate inflorescence with relatively short primary branches, and the relatively large flowers with suborbicular lateral lobes. In plant habit it much resembles *O. powellii* Schltr. from Panama, a species with much larger flowers with nearly solid brown sepals and petals.

Oncidium storkii Ames & C. Schweinf., *Sched. Orch.* 10:106. 1930. TYPE: Costa Rica, Santa Maria de Dota, *Lankester 1244* (holotype: AMES). Figure 36D.

Plant epiphytic, caespitose. Rhizome short; roots to 2 mm in diameter. **Pseudobulbs** pyriform, somewhat compressed, sulcate, 3–6 cm long, 2.5–4 cm wide, subtended by 2–4 foliaceous bracts, apically 2–3-foliate. **Leaves** coriaceous, elliptic-lanceolate, the larger 18–30 cm long, 2–3 cm wide, conduplicate at the base forming a short petiole, apically bluntly acute, 2-lobate. **Inflorescence** a lateral panicle, erect, 25–45 cm long including scape; primary branches 3 or more, recurved, secund 4–6 cm long, subtended by cymbiform bract, 3–3.5 cm long, to about 1 cm broad when spread; ovary and pedicel 1–2 cm long, subtended by triangular bracts 1.4–2 cm long. **Flowers** 3–8 per branch, 1.7–2 cm high, 1.3–1.5 cm broad, tepals green, unspotted, lip cream turning yellow, isthmus orange. **Sepals** dissimilar; dorsal erect, obovate, margins undulate, 7.5–9 mm long, 4–6 mm wide apiculate; lateral sepals shortly connate, lanceolate, carinate abaxially, 10–12 mm long, 4–5 mm wide. **Petals** oblong-ovate, obtuse to rounded, 7.5–9.5 mm long, 5–6 mm wide. **Lip** sessile, pandurate, 12–14 mm long, 7–9 mm wide; lateral lobes subquadrate; midlobe 1.3–1.5 cm wide, reniform, emarginate, and apiculate, forming a narrow isthmus at the base; callus at the base fleshy, elevated without apparent teeth. **Column** stout, 4–5 mm long, erect, with fleshy tabula infrastigmatica, apex with 2 porrect wings; pollinia 2, waxy, with prominent stipe and viscidium.

Rare epiphyte of premontane and montane cloud forests at 1150–1800 m. Flowering January to May. Endemic to Costa Rica and known only in the southern Central Valley.

Oncidium storkii is characterized by the unusual inflorescence structure, which consists of a panicle of second racemes, each with several green and yellow, unspotted flowers. *Oncidium bracteatum*, also with similar large inflorescence bracts, has yellow flowers with tepals spotted with dark brown. Also, the lip is deep yellow with dark brown around the isthmus, and there are more pronounced lateral lobes in that species.

Oncidium teres Ames & C. Schweinf., Sched. Orch. 8:78–80, t. 7. 1925. TYPE: Panama, Veraguas, San Francisco, *Powell* 383 (holotype: AMES, photo seen). Figure 35B.

Plant an erect to pendent, caespitose epiphyte; rhizome short; roots to 2 mm in diameter. **Pseudobulbs** globose, 1–15 mm high, 10–12 mm wide, subtended by nonfoliaceous bracts, apex 1-foliate. **Leaves** green tinted with maroon, terete, linear, sulcate, acute, 30–40 cm long, 1.5–1.6 wide. **Inflorescence** lateral, paniculate, 40–50 cm long including the scape. **Flowers** with tepals green spotted with brown, lip yellow, with reddish brown around the callus. **Sepals** similar, free, concave; dorsal suborbicular, rounded, and apiculate, 5–6 mm in diameter; lateral sepals obovate to triangular, acute to obtuse, 5–6 mm long, 3–4 mm wide. **Petals** obovate to oblong, obtuse to truncate and apiculate, with undulate margins, 6–8 mm long, 3–4 mm wide. **Lip** 3-lobate, pandurate, 1.3–1.4 cm long, 1–1.1 cm wide; callus, fleshy, without teeth, a lunate, horizontal plate basally, with a central rounded keel apically, and a pair of blunt lateral keels converging at the central keel apex. **Column** stout, 3 mm long, with 2 subquadrate to somewhat rounded wings apically; anther papillose, pollinia 2.

Epiphytic in the Golfito area, at 200–300 m. Flowering in April. Costa Rica and Panama; doubtfully reported from Nicaragua.

Oncidium warscewiczii Rchb. f., Bot. Zeitung (Berlin) 10:693–694. 1852. TYPE: Veragua: Chiriquí Vulkan, *Warscewicz* (lectotype selected here: w). Figure 37C.

Plant a caespitose epiphyte 10–30 cm tall excluding inflorescence; rhizome short; roots to 1–2 mm long. **Pseudobulb** shiny, ovoid to suborbicular, little compressed laterally, 4–9 cm long, 2.5–5 cm wide; subtended by 2–3 foliaceous bracts; apex 2-foliate. **Leaves** coriaceous, carinate beneath, petiolate; blades 6–30 cm long, 1.8–3 cm wide; apex asymmetrically obtuse. **Inflorescence** an erect, lateral, second raceme, somewhat recurved apically, 25–50 cm tall including the scape; ovary with pedicel 1–2.3 cm long, subtended and ex-

ceeded by a cymbiform, acute, and acuminate bract 1.5–3.5 cm long. **Flowers** campanulate (autogamous?), gregarious, lemon yellow with white callus, rarely marked with red. **Sepals** dissimilar; dorsal shortly unguiculate, obovate, concave, erect, 14–16 mm long, 5–7 mm wide; lateral sepals connate forming an emarginate blade 1.8–2 cm long, 1–1.2 cm wide. **Petals** ovate, 1.4–1.6 cm long, 8–9 mm wide, margins undulate, apex emarginate. **Lip** pandurate, concave 1.8–2 cm long, 1.5–1.6 cm wide, ca. 8 mm across lateral lobes; midlobe reniform, emarginate; isthmus ca. 5 mm wide; callus at the base fleshy, complex, farinose, broadened apically. **Column** large, 8–11 mm long, tabula infrastigmatica lacking, wings narrow, elongate, sometimes forming a lobe at the base. **Capsules** ellipsoid, 2–3 cm long including the beak; pedicel 1–1.5 cm long.

Epiphytic in cold, windy, montane cloud forests at 1500–2800 m. Flowering August to December. The quantities of capsules formed per inflorescence and the campanulate flowers suggest that at least some plants are autogamous, perhaps self-pollinated when shaken by strong winds. Costa Rica and Panama.

Oncidium warscewiczii is easily recognized by the shiny pseudobulbs, second racemes with yellow flowers, and large, cymbiform floral bracts. It is closely related to *O. bifrons* Lindl. (1857), described presumably from Mexico, and may be conspecific.

Excluded Taxa

Oncidium advena Rchb. f., Hamburger Garten-Blumenzeitung 16:422. 1860. Kraenzlin in his monograph cited this species for Costa Rica, but no specimens have been seen. The type from Venezuela includes a painting of the flower showing a broad isthmus similar to that of *O. ensatum* Lindl. or *O. sphacelatum* Lindl.

Oncidium lintricus Kraenzl., Pflanzenr. IV. 50(Heft 80):282. 1922. TYPE: Costa Rica, *Endres* (w). This entity is known only from the type, consisting of a fragment with flowers that appear immature. The drawing published with the original description looks similar to an immature flower of *O. polycladium* with midlobe not yet expanded, but the anther is clearly beaked.

Oncidium luridum Lindl., Edwards's Bot. Reg. 9: t. 727. 1823. This is reported from Mexico to Nicaragua, the Caribbean region, and northern South America. It might occur in mangrove swamps of the Caribbean coast, which have

been poorly collected, but neither herbarium specimens nor recent observations exist to substantiate its occurrence in Costa Rica.

Oncidium ornithorhynchum Kunth, Nov. Gen. et Sp. Pl. 1:345, t. 80. 1815. This species was listed for Costa Rica by Kraenzl. (Pflanzenr. IV. 50(Heft 80):201. 1922), citing a specimen collected by Endres. R. L. Dressler (pers. comm.) has indicated that this specimen is *O. klotzschianum* Rchb. f.; however, he has also heard of a superior form of *O. ornithorhynchum* said to have originated in Costa Rica.

Oncidium planilabre Lindl., J. Hort. Soc. London 6:59. 1851. This species is known from southern Nicaragua (Maderas Volcano) and from Panama southward. It may occur in Costa Rica, but no specimens have been seen. It should be recognized by the relatively short plant (ca. 30 cm tall) with ovoid, 2-foliate pseudobulbs and raceme of mostly brown flowers with yellow-tipped perianth segments.

Oncidium pumilum Lindl., Edwards's Bot. Reg. t. 920. 1825. This species is recorded for Costa Rica from a single herbarium (SEL 10440) prepared by C. Lankester from cultivated material claimed to have been collected by A. Skutch in the San Isidro area. Lankester often failed to label his plants and their origins, so the plant given him by Skutch was probably something else, perhaps a vegetatively similar species of *Trichocentrum*. Because *O. pumilum* is otherwise known only from South America, it is excluded from the flora.

Key to the Species of *Osmoglossum*

- 1a. Lateral sepals about $\frac{1}{3}$ connate, inflorescence rachis straight *S. convallarioides*
1b. Lateral sepals about $\frac{1}{2}$ connate, inflorescence rachis zigzag *S. egertonii*

Osmoglossum convallarioides Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:148. 1923. TYPE: Costa Rica, forests of Santa Rosa de Copé, Tonduz, s.n. (drawing of type: AMES). *Odontoglossum convallarioides* (Schltr.) Ames & Correll, Bot. Mus. Leaflet. 11:19. 1943. Figure 41C.

Plant epiphytic, caespitose, 30–40 cm tall. Rhizome

Osmoglossum Schltr.

(D. E. Mora de Retana)

REFERENCES—E. S. Ayensu and N. H. Williams, Leaf anatomy of *Palumbina* and *Odontoglossum* subgenus *Osmoglossum*. Amer. Orch. Soc. Bull. 41:687–696. 1972. F. Halbinger, *Odontoglossum* and related genera in Mexico and Central America. Orquídea (Mex.) 8:242–282. 1982.

Plant an epiphytic, caespitose herb. **Pseudobulbs** ovoid usually congested, compressed, subtended by several, distichous, imbricate bracts, apex 1–2-foliate. **Leaves** linear-ligulate, coriaceous, flexible, basally conduplicate, acute. **Inflorescence** a lateral raceme borne at the base of the uppermost leaf subtending the pseudobulb; peduncle compressed and provided with distichous bracts. **Flowers** nonresupinate, fleshy, spreading or campanulate. **Sepals** dissimilar; dorsal free, often cucullate; lateral free to variously connate forming a concave synsepal. **Petals** free, similar to the sepals, membranaceous or fleshy, usually somewhat concave. **Lip** sessile, porrect or geniculate, simple, adnate to column foot, about the same size as the sepals and petals; callus fleshy. **Column** short, with short foot, apex winged; pollinia 2, waxy, with stipe and viscidium. **Fruit** a capsule.

A small genus of about five species ranging from Mexico to Ecuador. Two species are recognized in Costa Rica.

The close relationship of *Osmoglossum* with *Palumbina* cannot be disputed on the basis of vegetative anatomy and gross morphology as found by Ayensu and Williams. Analysis of DNA by Chase and Palmer suggests that related *Palumbina* is a member of the *Lophiaris* clade, including the mule-ear oncidiums.

short; roots slender, to 2 mm in diameter. **Pseudobulbs** shiny, elliptic-ovoid, sulcate, compressed, 4–8 cm tall, 1–4 cm wide, concealed at the base by 3–5 foliaceous bracts, 1–2-foliate apically. **Leaves** coriaceous, flexuous, linear to narrowly oblanceolate, 25–42 cm long, 0.7–1.4 cm wide, forming a conduplicate petiole at the base, apically acute. **Inflorescence** a lateral raceme 25–30 cm long including the peduncle, borne in the uppermost foliaceous bract; ovary and pedicel 1.5 cm long, rarely exceeded by the subtending floral bract. **Flowers** 3–7, fragrant, small, nonresupinate, campanulate, 10–13 mm

high, 5–7 mm broad, white suffused with rose; callus and column yellowish orange. **Sepals** subequal, elliptic-lanceolate, concave, 7–9 mm long, 4–5 mm wide, acute, with a fleshy apicule; lateral sepals ca. $\frac{1}{2}$ connate. **Petals** elliptic-ob lanceolate, concave, 7–9 mm long, 5–6 mm wide, apiculate. **Lip** sessile, adnate to column base, obovate to subpandurate, markedly narrower in lower half, 7–9 mm long, 5–6 mm wide, lightly emarginate; callus basal, fleshy, with 2 short keels extended apically as teeth. **Column** stout, 3–4 mm long, with 2 porrect wings apically; pollinia 2, waxy, with well-developed stipe and viscidium. **Capsule** ellipsoid, 2.4–3 cm long; pedicel 0.8–1 cm long.

Epiphytic on the larger, shady trunks of trees of premontane and lower montane cloud forests at 1400–2000 (2700) m, often forming large masses. Flowering December to April. Reported Mexico to Panama.

Osmoglossum convallarioides is similar to *O. egertonii* (Lindl.) Schltr., which has larger flowers, nearly totally connate lateral sepals, and non-constricted lips.

Osmoglossum egertonii (Lindl.) Schltr., Orchis 10:166. 1916. *Odontoglossum egertonii* Lindl., Edwards's Bot. Reg. 31: misc. 50. 1845. TYPE: *Rucker s.n.* (K). *Osmoglossum acuminatum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 17: 79–80. 1922. TYPE: Panama, Chiriquí, *Powell* 255 (isotype: AMES). *Osmoglossum anceps* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19: 147–148. 1923. TYPE: Costa Rica, without precise locality, *A. and C. Brade* 1180 (isotype: AMES). Not *Odontoglossum anceps* Klotzsch, 1851. Not *Odontoglossum anceps* Lem., 1856. Figure 41D.

Plant epiphytic, caespitose, 30–40 cm tall. Rhizome short; roots slender, to 2 mm in diameter. **Pseudobulbs** shiny, elliptic-ovoid, compressed, sulcate, 6–10 cm long, 1.3–3 cm wide, subtended by 3–5 foliaceous bracts, 1–2-foliolate apically. **Leaves** coriaceous, flexuous, linear to narrowly oblanceolate, the larger 25–45 cm long, 1–1.5 cm wide, forming a conduplicate petiole, acute. **Inflorescence** a lateral raceme 30–40 cm long including the peduncle, usually shorter than the subtending foliaceous bract, rarely 1.2 times as long; rachis somewhat zigzag; ovary with pedicel 1–2 cm long. **Flowers** small, non-resupinate, white, callus yellowish surrounded with brown, column yellowish. **Sepals** subequal, obovate, apiculate, 15–16 mm long, 5–6 mm wide; dorsal erect, lateral sepals about $\frac{1}{2}$ connate. **Petals** similar to the sepals but smaller, obovate. **Lip** sessile, subrhombic, somewhat concave, apiculate, 13–14 mm long, 5–6 mm wide; callus fleshy, with 2 low keels converging and ending in front as 2 erect teeth, with a broad tooth at column base. **Column** stout, 5–7 mm long, with 2 porrect, fimbriate wings apically; anther cucullate; pollinia

2, waxy, with well-developed stipe and viscidium. **Capsule** ellipsoid, to 3.2 cm long; pedicel to 0.8 cm long.

Epiphytic in premontane and lower montane rain forests at 1000–1700 m (ca. 150 m in Talamancas). Flowering October to December. Reported from Mexico to Panama.

Osmoglossum egertonii closely resembles *O. convallarioides* but has larger flowers, lateral sepals that are connate for about half their length (see previous description), and a lip that is slightly narrower in the lower half. The name *O. egertonii* may prove not to fit the Costa Rican plants, because the presumed type (*Rucker s.n.* at K) with drawing shows a more acute lip and apparently less connate lateral sepals. The type locality is indicated as “Guatemala?” in the original description.

Otoglossum (Schltr.) Garay & Dunsterv.
(D. E. Mora de Retana)

REFERENCE—G. C. K. Dunsterville and L. A. Garay, Venez. Orch. Ill. 6:41. 1976.

Plant epiphytic, repent to somewhat viny. **Pseudobulbs** distant, oblong-ovate, subtended by conduplicate sheaths foliaceous or not, apex 1–2 foliate. **Leaves** fleshy to subcoriaceous, articulate, conduplicate. **Inflorescence** a lateral raceme. **Flowers** showy, large, flat or somewhat concave, yellow and reddish brown. **Sepals** dissimilar, spreading, ovate to obovate, obtuse, forming a short, obtuse mentum at the base. **Petals** similar to the dorsal sepal, ovate to obovate, obtuse. **Lip** adnate to column foot, deflexed near the base, 3-lobate, often pandurate, the midlobe sometimes 2-lobate. **Column** short, stout, with short, broad, recurved foot at base, winged above; pollinia 2 attached to subquadrate stipe by very short caudicles; viscidium small. **Fruit** a capsule.

A small genus of several (perhaps eight) species ranging from Costa Rica into South America. Only a single species is known from Costa Rica. *Otoglossum* is easily recognized by the widely separated and flattened pseudobulbs hidden by sheathing leaves and showy flowers.

The relationships of *Otoglossum* were considered by M. Chase to be with various species of *Oncidium* and with *Odontoglossum* sect. *Myanthium* (Syst. Bot. 11:477–491, 1986). More recent evidence from DNA analysis (Chase and Palmer 1992) suggests even more complex relationships involving *Ada*, *Aspasia*, *Brassia*, and *Symphoglossum*.

Otoglossum chiriquense (Rchb. f.) Garay & Dunsterv., Venezuelan Orchids Ill. 6:41. 1976.

Odontoglossum chiriquense Rchb. f., Bot. Zeitung 10:692. 1852. TYPE: Warscewicz (holotype: w, photo seen). *Odontoglossum coronarium* var. *chiriquense* (Rchb. f.) Veitch, Man. Orch. Pl. 1:23. 1886. Figure 41E.

Plant epiphytic, scandent. Rhizome very elongate, covered with rather large foliaceous bracts; roots 3–5 mm in diameter. **Pseudobulbs** oblong-ovoid, 4–8 cm long, 3–4 cm wide, concealed by 2 or more foliaceous bracts, apically 1–2-foliate. **Leaves** subcoriaceous, elliptic-ovate, the blade 10–20 cm long, 5–8 cm wide, petiolate at the base, obtuse to rounded apically, apiculate. **Inflorescence** a raceme of 5–10 flowers borne from the pseudobulb base, 30–45 cm long including the scape; ovary with pedicel 2–4 cm long. **Flowers** somewhat concave, 3–4 cm high, 5.5–5.8 cm broad; sepals and petals dull red spotted with yellow toward the receptacle; lip yellow at and below the isthmus. **Sepals** dissimilar with crisped margins; dorsal concave, suborbicular to obovate, rounded and apiculate, thickened abaxially near the base, 2–2.5 cm long, 2–2.3 cm wide; laterals oblong-oblancoelate, rounded and apiculate, 2–3 cm long, 1.5–1.7 cm wide. **Petals** similar to the lateral sepals, slightly constricted on the lower ½, 2–2.5 cm long, 2–2.3 cm wide. **Lip** 3-lobate, 2.5–2.7 cm long, 1.5–1.7 cm wide; midlobe obovate, forming an isthmus, rounded at the apex; lateral lobes much smaller than the midlobe; callus fleshy with numerous teeth. **Column** erect, 1 cm long, with small, irregularly toothed wings; pollinia 2, obovate, supported on a viscidium and distinct stipe.

Epiphytic and often rambling over canopies of premontane and lower montane rain forests at 1050–1800 m. R. L. Dressler reports (pers. comm.) that on Cerro Jefe, Panama, it may be found below 1000 m crawling about in open forests where there is sufficient light. Flowering June

to September. Costa Rica and Panama; possibly also into South America.

The very scandent habit of the plant and large, round, reddish brown flowers with mostly yellow lip are good field characters for recognition.

Pachyphyllum Kunth

(J. T. Atwood & D. E. Mora de Retana)

Plant a monopodial, few-branched epiphyte. Stems erect, creeping or pendulous, concealed by leaf sheaths; pseudobulbs lacking. **Leaves** conduplicate, distichous, articulate, chartaceous, coriaceous to fleshy, usually elliptic to oblong, with variously toothed margins. **Inflorescence** lateral, short, a few-flowered raceme; pedicel with articulation leaving a stubble behind on abscission. **Flowers** inconspicuous, green to whitish or yellowish, never red, orange, or purple, campanulate. **Sepals** similar, sometimes partially connate into a tube. **Petals** similar to the sepals, often adnate to the sepals forming part of the cup of the tube. **Lip** usually simple, sometimes somewhat 3-lobate, usually with a pair of tuberculate calli. **Column** simple, often with broad, dentate wings apically; pollinia 2, with simple stipe, or with a pair of stipes. **Fruit** a capsule, often 3-alaate.

A Neotropical and mostly Andean genus of about 35 species. Three species are known in Costa Rica.

Pachyphyllum is clearly related to *Fernandezia* Ruiz & Pavon, which differs in the much larger and much more colorful flowers with more complex pollinaria. Dressler (1993) places *Pachyphyllum* and *Fernandezia* in subtribe Oncidiinae on the basis of similarity in plant habits with *Lockhartia* and also on the similarity in pollinaria between *Fernandezia* and *Lockhartia*.

Key to the Species of *Pachyphyllum*

- 1a. Plants small and mosslike, the stems rarely exceeding 6 cm long; sepals, petals, and lip connate into a distinct cup or tube *P. hispidulum*
- 1b. Plants larger, the stems usually exceeding 6 cm long; sepals and petals not at all connate, not forming a cup or tube 2
- 2a. Sepals > 3 mm long *P. costaricense*
- 2b. Sepals < 3 mm long *P. crystallinum*

Pachyphyllum costaricense (Ames & C. Schweinf.) L. O. Williams, Lilloa 3:481. 1938. *Centropetalum costaricense* Ames & C. Schweinf., Sched. Orch. 10:110. 1930. TYPE: Costa Rica, San José, near Finca La Cima, above Los Lotes, North of El Copey, Standley

42600 (holotype: AMES, photo seen; drawing of type: SEL).

Plant epiphytic, small and inconspicuous. Stems to 12 cm long, concealed by loose, imbricating leaf sheaths; roots large and stout. **Leaves** densely disti-

chous, oblong, to 1.6 cm long, 4.5 mm wide, acute or shortly apiculate, spreading, apparently fleshy in the fresh plant, minutely ciliate especially on the apical margins. **Inflorescence** a lateral, short raceme of 3–4 flowers; ovary 3-axial; floral bracts funnel-shaped. **Flowers** white. **Sepals** fleshy, rigid, oblong-lanceolate or triangular-oblong; laterals ca. 4 mm long, 1.9 mm wide, acute, prominently keeled on the outer surface; dorsal sepal ca. 3.5 mm long, 1.4 mm wide. **Petals** oblong, similar to the sepals, ca. 1.15 mm wide. **Lip** rigidly attached to the short column foot, sigmoid when viewed laterally, oblong-lanceolate, with a saccate base, ca. 3.6 mm long, 1.8 mm wide, abruptly acute, apparently somewhat reflexed on the lower ½, with a pair of calli. **Column** short, 1.5 mm long, terminating in a broad, fleshy, lobulate wing; apparently each pollinium with separate stipe.

Endemic to Costa Rica at 2000–2400 m. The holotype was collected in flower in late December. The above description is based on the original description, on floral diagnoses from the type, and on a painting of a dissection showing separate stipes (Rodríguez, Mora, Barahona, & Williams, *Géneros de orquídeas de Costa Rica*, p. 255. 1986).

Pachyphyllum crystallinum Lindl., Orch. Linden. 18. 1846. TYPE: Venezuela, Merida, 10,000 ft, *J. Linden 686* (holotype: κ , photo seen). *?Pachyphyllum pastii* Rchb. f., Bonpl. 3: 239. 1855. Xen. Orch. 1:165, t. 58, fig. I(1–4). 1856. TYPE: Ecuador, *Jameson 439* (holotype: w, photo seen). *?Pachyphyllum stuebelii* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 7:204. 1920. TYPE: Colombia, Tolima, Volcán de Tolima, *A. Stuebel 213* (holotype: B, destroyed; drawing of holotype: AMES). Figure 42A.

Plant a scandent monopodial epiphyte of moss-covered shrubs and dwarfed trees. Stems to about 30 cm long, rarely branching below, covered by the sheaths of leaves about 5 mm apart; roots white, to 1.3 mm in diameter. **Leaves** fleshy, elliptic-ovate, apiculate, to 1.5 cm long and 8 mm wide, the margins hispidulous. **Inflorescence** a short, lateral raceme of 3–5 flowers in the leaf axils, supported by a peduncle to 6 mm long; ovary with jointed pedicel to 1.5 mm long, exceeding the subtending ovate, hispidulous floral bract. **Flowers** minute, light green, the perianth parts with denticulate margins. **Sepals** similar, cucullate; dorsal elliptic-ovate, acute, 1.7–1.8 mm long, 0.8–1.3 mm wide; lateral somewhat concave, 2–2.3 mm long, 1–1.3 mm wide. **Petals** elliptic-ovate, acute, 1.4–1.8 mm long, 0.7–1.1 mm wide. **Lip** narrowly ovate with the sides inflexed toward the column when young, becoming subsaccate at the base with age, slightly constricted just below the middle, provided with a pair of calli just below the constriction, apex reflexed with maturity, ca. 2 mm long and 1 mm wide in natural position. **Column** stout, becoming au-

riculate with maturity, ca. 1 mm long when young, ca. 1.5 mm long at maturity.

Epiphytic on shrubs in cold, wind-swept elfin forests at 3000–4000 m. Flowering season at least July and September and probably throughout the year. Costa Rica, Colombia, and Ecuador.

The small flowers and dentate margins of the separate perianth parts are good features for field recognition with a hand lens. Louis O. Williams used the name *P. pastii* Rchb. f. (*Ceiba* 5:251. 1956.) for these plants, a name adopted by Atwood (*Icon. Pl. Trop.* 14: t. 1375. 1989). We thank C. H. Dodson for identifying this species by the earlier name of *P. crystallinum*.

Pachyphyllum hispidulum (Rchb. f.) Garay & Dunsterville, Venez. Orch. Ill. 3:236. 1965. *Aeranthus hispidulus* Rchb. f., Linnaea 41:31. 1877. TYPE: Colombia, S. Martha, *Purdie* (holotype: w, photo seen). *Campylocentrum hispidulum* Rolfe, Orch. Rev. 11:246. 1903. *Orchidotypus hispidulus* (Rchb. f.) Senghas, Orchideen (ed. 3). 1923. 1995. *?Orchidotypus muscoides* Kraenzl., Bot. Jahrb. Syst. 37:383. 1906; Pflanzentr. IV. 50(Heft 83):51, t. 3C. TYPE: Peru, Province of Chota, Department of Cajamarca, *Weberbauer 4189*. (?) *Pachyphyllum muscoides* (Kraenzl.) Schltr., Repert. Spec. Nov. Regni Veg. 15:216. 1918. Figure 42B.

Plant an inconspicuous and usually pendent epiphyte 2–6 cm long. Stems weak, branching only at the base, concealed by the sheaths of 10–25 leaves; roots slender, to 1 mm in diameter. **Leaves** fleshy, distichous, 2–5 mm apart on each side of the stem, the sheaths with hispidulous margins and a pair of stipule-like appendages on each side of the articulation; blades falcate-lanceolate to elliptic, acute, diminishing in size apically, 2.5–8 mm long, 1–2 mm wide, with hispidulous margins. **Inflorescence** axillary, 1–3-flowered, shorter than the leaves; ovary with rudimentary pedicel about 1.5 mm long. **Flowers** minute, greenish yellow; the perianth ca. ½ connate forming a tube at the base about 1 mm long. **Sepals** with free portions ovate, abaxially keeled, to about 1 mm long, < 1 mm wide. **Petals** with free portions ovate, subsagittate, to about 0.8 mm long, ca. 0.7 mm wide. **Lip** similar to the petals, with claw united to the perianth tube, the free portion suborbicular, about 1 mm long, with a pair of rounded calli on each side below the base of the blade. **Column** to about 1.2 mm long, with a broad, cucullate anther bed; pollinia 2, with distinct stipe and viscidium. **Capsule** suborbicular, ca. 3 mm long, 2 mm wide.

Epiphytic on smaller branches at 2000–3150(3500) m. Flowering at least March, May, September and probably throughout the year. Cos-

ta Rica, Panama (Chiriquí), and at least northern Andean South America.

Plant habit and size match the type of *Aeranthus hispidulus*, and the flowers match those illustrated by Dunsterville and Garay (Venez. Orch. Ill. 3:237) and identified as *P. hispidulum*.

Of the three species of *Pachyphyllum* known in Costa Rica, this is the smallest, with stems less than 5 cm long, and is easily overlooked for a moss.

Plectrophora Focke

(D. E. Mora de Retana)

REFERENCE—M. W. Chase, Obligate twig epiphytism in the Oncidiinae and other Neotropical orchids. *Selbyana* 10:24–30. 1987.

Epiphytic, caespitose **herb**. **Pseudobulbs** small, suborbicular, subtended by conduplicate foliaceous sheaths, apex 1-foliate. **Leaves** articulate, fleshy, carinate, conduplicate, sometimes equitant. **Inflorescence** lateral, racemes or panicles with successively borne flowers; ovaries triolate in the Costa Rican species. **Flowers** campanulate, with conspicuous spur. **Sepals** subequal, the laterals forming an external spur. **Petals** usually broader than the sepals. **Lip** forming a spur at the base within the sepaline spur; blade simple, often with sides embracing the column. **Column** stout, usually without conspicuous wings or auricles; anther subglobose; pollinia 2, waxy with stipe and viscidium. **Fruit** a capsule.

A Neotropical genus of about nine species, most of which are twig epiphytes. A single species is known from Central America.

Little is known of the relationships of *Plectrophora* within the Oncidiinae. Chase (1986) places it within one of two major groups of the Oncidiinae characterized by the usual presence of a spur or nectary.

Plectrophora alata (Rolfe) Garay, Bot. Mus. Leafl. 21:261. 1967. *Trichocentrum alatum* Rolfe. Bull. Misc. Inform. 140:197. 1898. TYPE: Colombia, *Milican* (not seen). Figure 42C.

Plant epiphytic, caespitose, forming small clumps, ca. 15 cm tall. Rhizome very short; roots slender, < 1 mm in diameter. **Pseudobulbs** suborbicular, apically 1-foliate, 5–8 mm long, 6–7 mm wide, concealed at the base by 2–3 papery, triangular bracts. **Leaves** somewhat fleshy, elliptic-oblong, acute, abaxially carinate, 6–8 cm long, 1–1.3 cm wide, conduplicate at the base forming a short petiole. **Inflorescence** a lateral, short raceme of flowers opening successively; ovary and pedicel triolate,

2–2.2 cm long, subtended by much shorter, triangular, acute bracts. **Flowers** 2.5–3 cm high and 1.9–2.5 cm wide; sepals greenish white, petals white, lip white with pale yellow-orange nectar guides. **Sepals** subequal, elliptic-lanceolate, acuminate, carinate, directed forward but with the apex lightly recurved, 1.4–1.6 cm long, 4–6 mm wide; lateral sepals forming an external spur 1.9–2 cm long enclosing the spur formed by the lip. **Petals** much broader than the sepals, elliptic-obovate, 1.6–1.8 cm long, 1–1.2 cm wide, embracing the lip dorsally, the apex somewhat reflexed, retuse, apiculate; margins undulate and erose. **Lip** narrowed at the base into a spur; blade simple, subrhombic to ovate, adnate to the column, 1.5–1.7 cm long, 1.8–2 cm wide; erose margins undulate, with the sides upturned forming a trumpet and embracing the column; callus of 2 short, parallel lamellae or blunt keels. **Column** 4–5 mm long, erect, cylindrical, narrowed above, without wings; anther subglobose; pollinia 2, waxy, with stipe and prominent viscidium.

An uncommon twig epiphyte in premontane forests in shady, windy habitats at 670–1400 m. Flowering June and September. Costa Rica to northern South America; also reported from Guatemala.

Plectrophora alata is easily recognized by the light-colored, campanulate flowers with conspicuous spur. Unlike species of *Trichocentrum*, it has a sepaline spur enclosing a spur formed by the lip.

Psychopsis Raf.

(D. E. Mora de Retana)

Cespitose epiphytic **herb**. **Pseudobulbs** ovoid to suborbicular, compressed, coarsely rugose, 1-foliate. **Leaf** coriaceous, elliptic to oblong, dark green, often flushed or spotted with purple. **Inflorescence** a lateral raceme or few-branched panicle with successively borne flowers. **Flowers** yellow with red-brown markings, rarely pure yellow or yellow and white. Dorsal **sepal** and **petals** linear, reflexed; lateral sepals falcate, much shorter and broader than the petals. **Lip** 3-lobate, provided with a complex basal callus, midlobe broad and deeply emarginate. **Column** short, with complex auricles; pollinia waxy, 2, with viscidium and stipe. **Fruit** a capsule.

A Neotropical genus of four species, only one in Costa Rica. *Psychopsis* is easily distinguished by the antenna-like dorsal sepal and petals and by the broad, falcate lateral sepals.

Evidence from DNA analysis by Chase and Palmer suggests that *P. sanderae* is related to fleshy-leaved species of *Oncidium* and *Trichocentrum*.

Psychopsis krameriana (Rchb. f.) H. G. Jones, Novosti Sist. Nyssh. Rast. 12:141. 1975. *Oncidium kramerianum* Rchb. f., Allg. Gartenzei-

tung 23:9. 1855. TYPE: Ecuador, "Chimborasso," Warscewicz (holotype: w, photo seen). *Oncidium papilio* Lindl. var. *kramerianum* (Rchb. f.) Lindl., Fol. Orch. *Oncidium* 56. 1855. *Papiliopsis krameriana* (Rchb. f.) Morren ex Cogn. & Marsch, Pl. Feuill. Ornam. 2:55. 1874. *Oncidium kramerianum* var. *resplendens* Rchb. f., Gard. Chron. 3(3):360. 1888. TYPE: *Bull 1036* (holotype: w, photo seen). Figure 42D.

Plant epiphytic, caespitose. Rhizome short; roots grayish, 1–2 mm in diameter. **Pseudobulbs** suborbicular, somewhat compressed, coarsely rugose, 1.9–4 cm long, 2–3.2 cm wide, subtended by nonfoliaceous imbricate bracts, apically 1-foliate. **Leaf** coriaceous, minutely spotted with dark green or marbled with dull red, elliptic-oblong, 15–30 cm long, 4–6 cm wide, forming a short conduplicate petiole at the base, the apex acute. **Inflorescence** a lateral, erect or lightly arcuate, successively flowering raceme about 80 cm tall including the scape; ovary with pedicel about 2 cm long, subtended by somewhat shorter lanceolate bracts. **Flowers** large and spectacular, the dorsal sepal and petals reddish or purplish brown, the lateral sepals and lip yellow spotted with reddish brown and with a large yellow region on the lip. Dorsal **sepal** and **petals** similar, linear-filiform, 5–7 cm long, 4–6 mm wide, the apical half broadened and with undulate margins; lateral sepals very different from the dorsal sepal, narrowly ovate, falcate, 4–5 cm long, 1.3–1.6 cm wide, the apex subobtusely. **Lip** 3-lobate, pandurate, with undulate margins, 3.5–5 cm long, 3.2–5 cm wide; lateral lobes subquadrate; midlobe reniform; apex deeply emarginate, contracted at the base into a narrow isthmus; callus between lateral lobes basically of 3 ridges each terminating in a tooth, the central ridge transversely rugose. **Column** erect, complex, 9–11 mm long, with tabula infrastigmatica below, the apex broadly winged and with a pair of filiform appendages apically; pollinia 2, waxy, with fleshy stipe and viscidium; stigma entire.

Rare epiphyte on large branches in tropical lowland and premontane rain forests at 50–750 m. Flowering mostly September and October; year-round in cultivation. Costa Rica to western Ecuador. *Psychopsis krameriana* is easily distinguished by the large successive flowers borne on long scapes and the antenna-like dorsal sepal and lateral petals.

Key to the Species of *Psychmorchis*

- 1a. Flowers yellow with reddish spots; lip ≥ 10 mm wide *P. pusilla*
- 1b. Flowers entirely yellow; lip < 9 mm wide *P. pumilio*

Psychmorchis pumilio (Rchb. f.) Dodson & Dressler, Phytologia 24(4):288. 1972. *Oncidium pumilio* Rchb. f., Bot. Zeitung (Berlin) 10:697. 1852. TYPE: not seen. *Oncidium gnoma*

With regard to conservation, *P. krameriana* probably has never been a common plant. Currently, it is an extremely rare species in Costa Rica, known populations having been severely decimated by commercial collectors. Wild-collected plants are often hosts for a species of rust, and few plants are allowed through quarantine when brought into the United States. Clearly, mass propagation of selected clones to satiate markets are required to help curb indiscriminate and futile overcollection from wild populations.

Psychmorchis Dodson & Dressler
(D. E. Mora de Retana)

REFERENCE—C. H. Dodson and R. L. Dressler, Two undescribed genera in the Orchidaceae—Oncidiinae. Phytologia 24(4):285–292. 1972.

Plant epiphytic usually on twigs, iris-like, short-lived, without pseudobulbs. **Leaves** usually numerous, ensiform, remaining conduplicate to the apex, arranged in a fan, without articulations. **Peduncle** axillary, 1–12-flowered borne in succession. **Flowers** yellow or with red dots, the lip proportionately large. **Sepals** and **petals** similar, yellow, free and spreading or lateral sepals partially connate. **Lip** strongly 4-lobed and provided with a complex fleshy callus at the base. **Column** short, 2-winged; pollinia 2, waxy, supported on a stipe and viscidium. **Fruit** a capsule.

A Neotropical genus of perhaps six species, with two species known in Costa Rica. The plant habit and yellow flowers with large lip are the best characters for field recognition.

Chase and Palmer suggest that *Psychmorchis* is related to several Brazilian taxa, including *Oncidium crispum*, *O. pubes*, and *Gomesa planifolia*. The unique psygmoid plant habit and reduced chromosome numbers (2n = 10) suggest that *Psychmorchis* is basically a paedomorphic *oncidium*.

Kraenzl., Pflanzenr. IV. 50(Heft 80):98–99. 1922. TYPE: Locality unknown, Sander (photo of type: AMES). *Oncidium titania* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:67. 1923.

TYPE: Costa Rica, "Carillo" (Carrillo?), *Wercle 63* (drawing of type: AMES). ?*Oncidium oberonia* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 27:113. 1924. TYPE: Colombia, Mocoa (Territorio del Caqueta), *Hopp 207. Oncidium hondurenses* Ames, Bot. Mus. Leaffl. 1(5):31–35, t. 1933. *Tolumnia pumilio* (Rchb. f.) Hoehne, Iconografia Orch. Bras. 231. 1949. *Psychmorchis gnoma* (Kraenzl.) Dodson & Dressler, Phytologia 24(4):289. 1972. Figure 43A.

Plant an epiphyte with 1–3 shoots, very small, 1–3.5 cm high excluding inflorescence, rhizome short; roots < 1 mm in diameter. **Leaves** equitant, fleshy, 10–15 per shoot distributed in a fan; each elliptic-lanceolate and subfalcate in profile, 8–35 mm long, 2–5 mm deep. **Inflorescences** lateral, 1–several per shoot; each a successively flowering raceme of 2–4 flowers 2–4 cm long including the filiform peduncle; ovary with pedicel 5–7 mm long, subtended by a much shorter ovate, acute floral bract. **Flowers** yellow, without spots, 8–14 mm high. **Sepals** dissimilar, dorsal elliptic-ovate, acuminate, 2.5 mm long, 1.7 mm wide; lateral sepals ca. ½ connate, reflexed at the base; each linear-lanceolate, acute, 2.8–3 mm long, 0.6–0.8 mm wide. **Petals** obliquely ovate, acute, 2.8–3 mm long, 2–2.3 mm wide. **Lip** 3-lobate, pandurate, 5–6 mm long, 6–7 mm wide; margins undulate; basal lobes broad, dolabriform; midlobe deeply emarginate, obscurely reniform; callus fleshy, cuneate at the base, elevated and papillose apically. **Column** short, fleshy, 2–3 mm long including conspicuous dolabriform wings beside the stigma; pollinia 2, waxy, with conspicuous stipe and viscidium. **Capsules** ca. 2 cm; pedicel 5 mm long.

Epiphytic on twigs and vines in tropical lowland and premontane rain forests at 300–1200 m. R. L. Dressler (pers. comm.) relates its occurrence on cultivated azaleas; it is also common in abandoned coffee plantations. Flowering December to February. Reported from Guatemala to northern and Andean South America.

Psychmorchis pumilio appears similar to a miniature *P. pusilla*, but the flowers are entirely yellow, and the callus has a fimbriate margin. Plants may flower when less than 1 cm tall.

Psychmorchis glossomystax (Rchb. f.) Dodson & Dressler has been reported from Costa Rica. It is similar to *P. pumilio* in its callus, but generally has larger flowers with reddish brown spots, and the lobes of the lip are more rounded. No herbarium specimens identifiable as *O. glossomystax* have surfaced from Costa Rica.

Psychmorchis pusilla (L.) Dodson & Dressler, Phytologia 24:288. 1972. *Epidendrum pusillum* L., Sp. Pl. (ed. 2):1352. 1763. TYPE: not seen. *Cymbidium pusillum* (L.) Sw., Nov. Act. Upsal.

6:74. 1799. *Oncidium pusillum* (L.) Rchb. f. Ann. Bot. Syst. 6:714. 1863. *Tolumnia pusilla* (L.) Hoehne, Icon. Orch. Bras. 231. 1949.

Plant a caespitose twig epiphyte 2.5–8 cm tall, fanlike; rhizome nearly absent; roots to 1 mm in diameter. **Pseudobulbs** lacking, the stem concealed by leaf bases. **Leaves** coriaceous to fleshy, conduplicate, distichous, imbricate, falcate-lanceolate in profile, lacking articulations, 2–8 cm long, 3–10 mm deep or high (measured from margin to midrib). **Inflorescences** lateral in the leaf axils, ≤ 12 per shoot; each a successively flowered, condensed raceme (rarely with 1 branch) to 1.5 cm long supported on a peduncle 1.5–6 cm long covered by 2–3 compressed sheaths each producing a subulate, incurved blade; ovary with pedicel glabrous, 8–10 mm long, subtended by a laterally flattened subulate bract 2–3 mm long. **Flowers** bright yellow, the petals and base of the lip spotted with brick red; callus and column usually white marked with red. **Sepals** dissimilar, inconspicuous, about 5 mm long; dorsal ovate, apiculate; lateral sepals lanceolate-falcate, acute. **Petals** larger than the sepals, ovate-elliptic, 6–8 mm long, 3–5 mm wide. **Lip** 3-lobate but the midlobe 4-lobulate, 10–18 mm long; 9–20 mm wide, the lateral lobes broadly rounded; midlobe with 4 lobules similarly rounded; margins undulate; callus basal, fleshy, consisting of 1 basal plate, 2 lateral plates, and 1 folded plate at the apex. **Column** stout, 2.5–3.5 mm long; wings broad, coarsely dentate. **Capsules** ellipsoid to obovoid, 2–3 cm long; beak short; pedicel short.

Epiphytic mostly on twigs and vines in tropical lowland and premontane rain forests at 0–800 m. Flowering throughout the year. Locally common in Costa Rica; reported throughout most of the Neotropics.

Psychmorchis pusilla has the larger plants and flowers among Costa Rican *Psychmorchis*. The yellow flower spotted with red and nonfimbriate callus further distinguish it.

Rhynchosele Rchb. f.

(Including the following synonyms: *Odontoglossum* Kunth sect. *Rhynchosele* (Rchb. f.) Halb., *Cymbiglossum* Halb., and *Lemboglossum* Halb.)

(D. E. Mora de Retana)

REFERENCE—M. Soto Arenas, G. A. Salazar, and A. Rojas, Nomenclatural changes in *Rhynchosele*, *Mesoglossum*, and *Lemboglossum* (Orchidaceae, Oncidiinae). Orquídea (Méx.) 13:145–152. 1993.

Epiphytic or terrestrial caespitose to rhizomatous herb.

Pseudobulbs ovoid, usually strongly compressed laterally, subtended by 1–4 foliaceous bracts; apex 1–2 foliate. **Leaves** articulate, conduplicate, elliptic to lanceolate, chartaceous to coriaceous. **Inflorescence** a scapose raceme borne laterally at the pseudobulb base, of 1–20 flowers. **Flowers** usually spreading, large and colorful. **Sepals** lanceolate, usually attenuate. **Petals** often shorter and broader than the sepals, ovate to lanceolate, attenuate. **Lip** free, with claw with bilamellate callus. **Column** slender, straight to slightly arcuate, broadened near the stigma; pollinia 2, supported on a viscidium and stipe. **Fruit** a capsule.

A genus of about 16 species ranging from Mexico to Panama. Three species are confirmed from Costa Rica, although there are reports of five (see notes under *R. hortensiae*). The plants with char-

acteristically large and attractive flowers are valuable to collectors. Probably because of their value, few plants have been preserved as herbarium specimens, making documentation difficult.

The relationships of *Rhynchostele* are unresolved, although the work of Chase and Palmer suggests an alliance of *R. cervantesii* with *Rossioglossum* and *Ticoglossum*. To minimize confusion, we are following R. L. Dressler (pers. comm.) and the reference cited above in recognizing the species included here under the genus *Rhynchostele*. These have been variously accepted under the genera *Odontoglossum*, *Cymbiglossum*, and *Lemboglossum*, and we predict more transfers in the future.

Key to the Species of *Rhynchostele*

- 1a. Inflorescence of 10–20 flowers; lip cordate, lavender *R. bicktoniensis*
- 1b. Inflorescence of 1–5 flowers; lip trulliform or triangular, whitish, suffused or marked with reddish brown 2
- 2a. Inflorescence with 2–5 flowers at a time *R. hortensiae*
- 2b. Inflorescence with a single flower at a time *R. stellata*

Rhynchostele bicktoniensis (Bateman) Soto Arenas & Salazar, *Orquídea* (Méx.) 13:147. 1993. *Cyrtorchilum bicktoniense* Bateman in *Orch. Mex. and Guat.* t. 6. 1837. *Odontoglossum bicktoniense* (Bateman) Lindl. in *Edwards's Bot. Reg.* 26:66. 1840. *Cymbiglossum bicktoniense* (Bateman) Halb., *Orquídea* (Méx.) 9:2. 1983 (nom. illeg.). *Lemboglossum bicktoniense* (Bateman) Halb. ex Christenson, *Lindleyana* 3:222. 1988. Figure 43B.

Plant epiphytic, somewhat climbing. Rhizome short; roots grayish, 3–5 mm in diameter. **Pseudobulbs** elliptic, compressed, 5.5–7 cm long, 2.7–3 cm wide, subtended by 2–3 foliaceous bracts; apex 2–3-foliate. **Leaves** subcoriaceous, elliptic-lanceolate, acute, carinate, conduplicate and articulated to the sheath; blade 17–38 cm long, 2.5–3.6 cm wide. **Inflorescence** lateral from the base of the pseudobulb, a raceme, 25–30 cm long including the scape; ovary with pedicel 3–5 cm long. **Flowers** 2–3 cm long, 2.5–3.5 cm wide, with tepals greenish yellow spotted with red, lavender lip, column red-maroon. **Sepals** free, dissimilar, apically and abaxially carinate; dorsal cucullate, elliptic-oblong, acute, apiculate, 1.6–1.8 cm long, 9–11 mm wide; lateral subfalcate, elliptic-lanceolate, acute, apiculate, the margins lightly undulate, 1.9–2.1 cm long, 6–7 mm wide. **Petals** similar to the sepals but smaller, 1.7–1.9 cm long, 6–7 mm wide. **Lip** subcordate, united by the claw to the base of the column, the margins undulate, 2.3–2.5 cm long and broad; callus a pair of fleshy, elevated keels at the base, with numerous translucent hairs and with 2 lamellae prolonged to

the apex. **Column** semiterete, 1.2–1.5 cm long, apex with a pair of porrect dolabriform wings; pollinia 2, waxy, pyriform, with elongate stipe and viscidium.

In Costa Rica this species grows terrestrially in humus with *Rubus* in montane rain forests at 2000–2500 m. Flowering according to collectors in May, June, September, and October. Reported from Mexico, Guatemala, El Salvador, Costa Rica, and Panama.

Rhynchostele bicktoniensis is easily recognized by the elongate raceme with maroon-spotted green tepals and large, subcordate, lavender lip.

Rhynchostele hortensiae (R. L. Rodr. C.) Soto Arenas & Salazar, *Orquídea* (Méx.) 13:149. 1993. *Odontoglossum hortensiae* R. L. Rodr. C., *Orquídea* (Méx.) 7:150–154, fig. 1979. **TYPE:** Costa Rica, Province of Cartago, *Glicenstein sub R. L. Rodríguez 1560* (holotype: USJ; isotypes: AMES, F). *Lemboglossum hortensiae* (R. L. Rodr. C.) Halb., *Orquídea* (Méx.) 9: 353. 1984. Figure 43C.

Plant a shortly creeping epiphyte. Rhizome short; roots to 3 mm in diameter. **Pseudobulbs** elliptic-ovoid, strongly compressed laterally, 4–8 cm long, 2.5–4 cm wide, subtended by 2–4 foliaceous bracts, apically 1-foliate. **Leaves** elliptic, softly coriaceous, acute, apiculate, with a prominent abaxial keel, to 8–20 cm long, 2–

4 cm wide. **Inflorescence** a lateral, 2–5 flowered raceme borne laterally at the base of the mature pseudobulb, 20–45 cm long including the scape, scape compressed, partly concealed by triangular, carinate bracts; ovary with pedicel about 3 cm long. **Flowers** large, 5–7 cm in diameter, greenish white with maroon spots; lip bordered and spotted with dark reddish brown. **Sepals** free, similar, lanceolate, attenuate, 3.5–4.5 (5.2) cm long, 8–12 mm wide, the margins smooth; dorsal erect; lateral with incurved apices. **Petals** shorter and broader than the sepals, ovate, attenuate, with undulate margins, 3–4(5) cm long, 1–1.4 cm wide. **Lip** trulliform to rhombic, united to the base of the column by a short claw, attenuate, 2.6–3.5 cm long, 1.8–2.3 cm wide, the margins coarsely dentate; callus at the base, fleshy, pilose to velutinous, of 2 short, lateral keels and a longer central keel. **Column** subterete, wingless, with broadened apex, 1.5 cm long; another subglobose; pollinia 2, obpyriform, with elongate stipe and elongate viscidium.

Rhynchostele hortensiae is a species of moist and windy montane cloud forests at 1700–2500 m. It grows upward on trunks and larger branches, appearing repent despite the short rhizome. Flowering March to May. Endemic to Costa Rica.

This species is easily recognized by the pale yellowish green plant, the strongly compressed pseudobulbs formed successively in one direction, and the large, spotted flowers with trulliform lip and dentate margins.

Both *R. cordata* (Lindl.) Soto Arenas & Salazar and *R. maculata* (La Llave & Lex.) Soto Arenas & Salazar have been reported from Costa Rica, but no reliable vouchers of these species have been seen. We believe that *R. hortensiae* has been confused with both species. *Rhynchostele cordata*, otherwise known from Mexico to Nicaragua and reported from Venezuela, is most similar to *R. hortensiae*, but the flowers have a more spotted color pattern, and the lip is clearly basally cordate with less dentate margins and a more poorly defined red-purple border. One collection at F (Roy W. Lent 1618) has been repeatedly identified as *R. cordata*, but the lip base is clearly broadly cuneate with coarsely dentate margin, and the color notes of the collector indicate the “lip edged in the same color [brownish wine-red].” Another specimen (C. H. Lankester s.n. at SEL) is clearly *R. cordata* and indicates “Candelaria,” a Costa Rican locality, but is based on cultivated material that could have easily been confused in cultivation. Charles Lankester is known to have imported and grown orchids from around the world, not just from Costa Rica, and his living plants were not well-labeled.

The occurrence of *R. maculata* is based on a report by C. Horich (Orchideología 10:265–278.

1975), who included a photograph of *R. hortensiae* (not then described) as *Odontoglossum maculatum*. Rodrigo Escobar (Orchideología 11:21–49. 1976), when writing about *Odontoglossum maculatum*, stated, “but a variety exists in Costa Rica, with white, instead of yellow petals.” This probably was of *R. hortensiae*. Without verifiable herbarium specimens, we cautiously exclude both *R. cordatum* and *R. maculatum* from the flora.

***Rhynchostele stellata* (Lindl.) Soto Arenas & Salazar, Orquídea (Méx.) 13:151. 1993. *Odontoglossum stellatum* Lindl., Edwards’s Bot. Reg. 27: misc. 9. 1841. TYPE: Mexico, Hartweg (K, not seen) *Cymbiglossum stellatum* (Lindl.) Halb., Orquídea (Méx.) 9:4. 1983. *Lemboglossum stellatum* (Lindl.) Halb., Orquídea (Méx.) 349. 1984. Figure 43D.**

Plant a caespitose epiphyte, 10–15 cm high; rhizome short; roots to 2 mm in diameter. **Pseudobulbs** ovoid to lanceolate, compressed, 2.5–8 cm long, 1.3–1.5 cm wide, subtended by nonfoliaceous sheaths, apex 1-foliate. **Leaves** petiolate; blade subcoriaceous, carinate, elliptic to lanceolate or oblanceolate, 10–14 cm long, 1.5–2 cm wide; apex acute. **Inflorescences** 1–2 per shoot, scapose, lateral, with 1 rarely 2 successive flowers; triquetrous ovary with pedicel 4–7 cm long, subtended by a much shorter lanceolate bract 7–10 mm long. **Flowers** large and attractive; sepals and petals yellowish brown with yellow apices, lip white suffused with lavender. **Sepals** free, similar, linear elliptic to lanceolate, attenuate, 1.9–2.2 cm long, 3–4 mm wide. **Petals** similar to the sepals, 1.9–2.2 cm long, 3–4 mm wide. **Lip** with a claw about 8 mm long, parallel with and embracing the column; blade reflexed, simple to lightly 3-lobate, concave, ovate to rhombic, 2.8–3.2 cm long, 1.7–2 cm wide; apex acute to obtuse; margins coarsely dentate and undulate; callus at the base fleshy, projected beyond the claw, as a pair of small, lateral teeth, in front of which is an additional, emarginate callus. **Column** straight, broadened at the apex, lightly verrucose, 1.3–1.5 cm long; anther shortly beaked; pollinia 2, with elongate stipe and viscidium. **Capsules** from Costa Rica unknown, in one specimen from Mexico 3.1 cm long including the beak.

Rhynchostele stellata grows in cloud forests at about 1500 m. Flowering May and June. Reported from Mexico to Panama (not Nicaragua) and Venezuela.

Rhynchostele stellata is easily recognized by the single, proportionately large flower per inflorescence supported on a long pedicellate, triquetrous ovary. It is known in Costa Rica by a single collection near Ciudad Quesada made by an inspector from the Costa Rican wildlife office. It was to be expected in Costa Rica because it is

known from both northern Central America and Panama.

Rodriguezia Ruíz & Pavón

(D. E. Mora de Retana)

Plants epiphytic, caespitose to rhizomatous, often forming large clumps; rhizome short or elongate, covered by persistent bracts. **Pseudobulbs** compressed, apex 1–2-foliate. **Leaves** conduplicate, coriaceous, ligulate to elliptic. **Inflorescences** 1–several, each a raceme formed in the axils of the foliaceous bracts. **Flowers** usually showy. **Sepals** dissimilar, the dorsal erect, the lateral sepals variously connate forming a spur. **Petals** subequal to the dorsal sepal. **Lip** usually exceeding the sepals, entire or emarginate. **Column** erect, the apex dilated and often with a pair of auricles, the base footless; pollinia 2, waxy. **Fruit** a capsule.

A Neotropical genus of about 34 species, but with only one species in Costa Rica. In Mesoamerica, a second species, *R. lanceolata* Ruíz & Pavón, occurs in neighboring Panama, and *R. dressleriana* R. González has been described from Mexico.

Cladistic analysis based on DNA strongly supports a relationship with *Scelochilus* and *Comparettia*.

Rodriguezia compacta Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:144. 1923. TYPE: Costa Rica, Atlantic coastal hills, A. & C. Brade 1309, 1310 (drawing of type: AMES, photo seen). Figure 44A.

Plant epiphytic, never forming large clumps, to about 15 cm tall. Rhizome short; roots rather large, to 1.5 mm in diameter. **Pseudobulbs** compressed, ovoid, 1.5–3.5 cm long, 1–1.3 cm wide, nearly covered by the sheaths of 3–6 foliaceous bracts; apex 1(2)-foliate. **Leaves** coriaceous, articulate, oblong to elliptic, broadly rounded or obtuse apically, appearing unequally 2-lobed in pressed specimens, 3.5–15 cm long, 1.2–3 cm wide. **Inflorescences** lateral, 1–several per shoot, each a raceme of 1–5 flowers, 5–8 cm long including the peduncle, much shorter than the leaves; ovary with pedicel to about 1.5 cm long, each subtended by a conduplicate, subulate bract 5–15 mm long. **Flowers** white to light yellow, the lip yellow with 2 orange lines opposite the column apex. **Sepals** dissimilar; dorsal oblanceolate, 1.8–3.3 cm long, 8–13 mm wide, obtuse; lateral sepals connate forming an oblong synsepal, more or less conic-saccate at the base concealing the nectary, bifid apically, 1.5–3 cm long, about 10 mm wide. **Petals** oblanceolate to subspatulate, rounded to lightly emarginate when flattened and apiculate, 2–3 cm long, 8–15 mm wide, the margin minutely dentate. **Lip** cuneate, obovate to spatulate when flattened, 2–3.5 cm long, 1.3–1.5 cm wide,

with a recurved spur at the base, with margins inrolled forming a tube, emarginate apically; callus with 2 fleshy keels. **Column** clavate, 1.5–1.7 cm long with a pair of falcate auricles apically; anther with beak, pollinia 2, with long stipe.

Epiphytic in lowland rain forests at 15–100 m; in Nicaragua recorded to 200 m. Flowering June to November. Locally common from Nicaragua to Panama.

This species is easily recognized in Costa Rica by the shape of the column with apical horns and the synsepal forming a recurved spur.

Rossioglossum (Schltr.) Garay & Kennedy

(D. E. Mora de Retana)

REFERENCE—L. A. Garay and G. Kennedy, The genus *Rossioglossum*. Orch. Dig. 40:139–143. 1976.

Plant a caespitose epiphyte; rhizome short; roots thick. **Pseudobulbs** suborbicular to ovoid or obovoid; subtended by nonfoliaceous bracts; apex 2-foliate. **Leaves** petiolate, conduplicate. **Inflorescence** a lateral raceme of 3–20 flowers. **Flowers** large and attractive, yellow marked variously with reddish brown. **Sepals** similar. **Petals** usually broader than the sepals. **Lip** 3-lobate; callus fleshy, with several teeth. **Column** stout, with lanceolate wings apically; pollinia 2, supported on a stipe and viscidium. **Fruit** a capsule.

A small Mesoamerican genus of five to six species, one in Costa Rica. Relationships are unclear but are apparently with *Ticoglossum* and possibly *Palumbina* and *Rhynchostele*.

Rossioglossum schlieperianum (Rchb. f.) Garay & Kennedy, Orch. Dig. 40:143. 1976. *Odontoglossum schlieperianum* Rchb. f., Gard. Chron. 1082, (fig.). 1865. TYPE: Costa Rica, ?Wendland (w, not seen). Figure 44B.

Plant an erect, caespitose epiphyte to about 40 cm tall; rhizome short; roots ≤ 4 mm in diameter. **Pseudobulbs** grayish green, biconvex, lightly sulcate, ovoid to obovoid, 4–9 cm long, 2.5–6.5 cm wide; subtended by nonfoliaceous bracts; apex sometimes emarginate, 2(3)-foliate. **Leaves** deep gray-green, base forming a conduplicate petiole; blade subcoriaceous, carinate abaxially, elliptic-oblanceolate, 10–30 cm long, 3–7 cm wide; apex acute. **Inflorescence** a lateral raceme of 3–8 flowers 25–40 cm high including scape; ovary with pedicel 3–6 cm long, subtended by a membranaceous, cymbiform bract 1.5–2.5 cm long. **Flowers** sulfur yellow; tepals barred with rust red on lower half; lip whitish with reddish brown isthmus; callus yellow and red. **Sepals** subequal, elliptic, acute or apiculate, margins undulate; dorsal

erect, 4.5–5.2 cm long, 1.5–2.1 cm wide; lateral connate basally, subfalcate, 4.5–5.2 cm long, 1.4–1.7 cm wide. **Petals** much broader than sepals, elliptic ovate to obovate, 4.8–5 cm long, 2–2.3 cm wide, acute to obtuse and apiculate, margins undulate. **Lip** 3-lobate, 3.1–4 cm long, ca. 1 cm across the lateral lobes, 1.9–2.4 cm wide at the apex; lateral lobes rounded; midlobe obovate, concave, the apex lightly to deeply emarginate; callus at the base prominent and fleshy, of 4 diverging teeth, the apical pair particularly thickened and mammillate. **Column** short, erect, about 1 cm long, broadened apically and with 2 pubescent, lanceolate auricles; pollinia 2, waxy, with stipe about 1.5 mm long and viscidium. **Capsule** 5–6 (or more?) cm long.

Trunk epiphyte in moderate shade of very tall trees in humid evergreen cloud forests at 1200–1800 m. Flowering May to July. Costa Rica and Panama.

Rossioglossum schlieperianum is easily distinguished in Costa Rica by the large yellow flowers marked with reddish brown. Pure yellow forms have been reported.

Excluded Taxon

Rossioglossum williamsianum Rchb. f., Gard. Chron. 16:134. 1881. TYPE: *B. S. Williams*. This was reported by B. S. Williams (Orchid Grower's Manual, 1894) as having been imported from Costa Rica in a shipment with *Odontoglossum* (*Rossioglossum*) *schlieperianum*. The report has since been repeated by others, but no recent specimens nor reliable reports support Williams' claim. It is most likely that the species originated from northern Central America and the labels were confused in cultivation.

Scelochilus Klotzsch

(Including *Neokoehleria* Schltr.)

(D. E. Mora de Retana)

REFERENCE—K. Senghas, Die Gattung *Scelochilus*, mit einer neuen Art, *Scelochilus rubriflora*, aus Peru. *Orchidee* (Hamburg) 38:114–123. 1987.

Cespitose, usually small, epiphytic herb. **Pseudobulbs** small, sometimes hidden by subtending, rarely foliaceous sheaths; apex 1-foliate. **Leaves** conduplicate, coriaceous. **Inflorescence** a lateral raceme or panicle. **Flowers** colorful, small, campanulate, with conspicuous spur. **Sepals** dissimilar, the laterals variously connate, forming a single spur at the base. **Petals** simple, similar

to the dorsal sepal. **Lip** complex, elongate; base with a pair of spurs included within the sepaline spur; apex broadened, often with involute margins; lamina usually adorned with 1–2 pairs of horns and variously pubescent. **Column** usually clavate; pollinarium variable, pollinia 2, with short to elongate, rarely furcate stipe and viscidium. **Fruit** a capsule.

A genus of perhaps 50 montane species with small, very odd, colorful flowers superficially similar to those of *Corydalis*. The center of distribution is in Andean South America with possibly two in Central America, with only one known from Costa Rica.

Floral morphology as well as DNA evidence of Chase and Palmer suggest that *Scelochilus* is related to *Comparetia* and *Rodriguezia*.

Scelochilus aureus Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:144–145. 1923. TYPE: Costa Rica, Tabbazo (Tablazo), A. & C. Brade 1063 (drawing of type: AMES). Figure 44C.

Plant a small, cespitose, pendent or arcuate epiphyte; rhizome short; roots to 1 mm in diameter. **Pseudobulbs** subcylindric to fusiform, compressed, 2.2–2.4 cm long, 4–6 mm wide; subtended by 2–3 subulate, nonfoliaceous bracts; apex 1-foliate. **Leaves** coriaceous to fleshy, petiolate; blade elliptic-lanceolate or oblanceolate, carinate beneath, 8–12 cm long, 1.5–3.7 cm wide; apex recurved and acuminate. **Inflorescence** lateral, arcuate or pendent, a raceme or panicle, 12–15 cm long including scape; each branch with 4–6 successively borne flowers; ovary with pedicel 8–11 mm long subtended by subulate bracts ca. 5 mm long. **Flowers** campanulate, 1.2–1.6 cm long, yellow to orange; petals and lip lined with wine red. **Sepals** dissimilar; dorsal free, concave, oblong-obovate, obtuse, 1.2–1.4 cm long, 8–9 mm wide; laterals connate forming a synsepal 1.4–1.6 cm long, 8–10 mm wide, spur at base 4 mm long, apex emarginate. **Petals** similar to dorsal sepal in shape and size. **Lip** complex, elongate, 1.4–1.6 cm long, 4–5 mm wide, with 2 spurs inserted within the sepaline spur; blade with a pair of slender, acute, retrorse, hornlike auricles near the middle and a second pair near base of apical lobe, lightly velutinous; apex suborbicular and emarginate with involute margins. **Column** subterete, dilated apically, lightly velutinous ventrally, 8 mm long; pollinia 2, globose, supported on a furcate stipe and viscidium.

Rare epiphyte on small branches of windy premontane and lower montane cloud forests at 1500–2000 m. Flowering season imperfectly known, at least August to October; possibly June to December during the rainy season. Apparently endemic to Costa Rica.

The yellow to orange, campanulate flowers appearing similar to those of *Corydalis* (Fumariaceae) are good features for field recognition.

We exclude *S. aureus* from synonymy with *S.*

tuerckheimii Schltr., a species described from Guatemala with smaller flowers and a narrower, rounded midlobe. The larger flower size, emarginate midlobe of lip, and the shorter notch produced by the lateral sepals agree with *S. aureus*, not *S. tuerckheimii*; both are otherwise very closely related species. Schlechter's descriptions of the column and ovary ("c. 2 cm longo") in *S. aureus* match nothing seen from Costa Rica and are probably erroneous. The above description is based in part on plants recollected in the type locality.

Sigmatostalix Rchb. f.

(D. E. Mora de Retana)

Plant a caespitose epiphyte. Rhizome short, rarely creeping; roots slender. **Pseudobulbs** small, elliptic to oblong to ovoid, compressed, subtended by several imbricate, folia-

ceous bracts; apex 1–2-foliate. **Leaves** linear to elliptic-lanceolate, acute, acuminate or asymmetrically 2-lobate. **Inflorescence** a lateral raceme or panicle with few–many flowers; usually each shoot with several inflorescences at the same time. **Flowers** small, often accompanied by several bracts beneath the floral bract; floral bracts membranaceous, triangular, often funnel-shaped. **Sepals** subequal, spreading or reflexed, free or connate at the base. **Petals** similar to the sepals. **Lip** conspicuous, subsessile or long-clawed, often united to the base of the column, entire or 3-lobate, usually with fleshy callus. **Column** slender and arched or stout, terete, erect, often dilated at the apex; pollinia 2, waxy, ovoid on a single stipe and with filiform caudicles. **Fruit** a capsule.

A Neotropical genus of about 35 species; six species are here treated for Costa Rica. The genus is easily recognized by the usually small flowers (often brightly colored) with bizarre shapes and usually very slender, arcuate column and the tendency to produce several bracts per flower. *Sigmatostalix* is apparently related to several sections of *Oncidium*, but little more is known of its relationships.

Key to the Species of *Sigmatostalix*

- 1a. Lip with claw 2
 - 2a. Claw of the same length as the blade of the lip; lateral lobes of lip prominent and slender *S. unguiculata*
 - 2b. Claw shorter than the blade of the lip; lateral lobes neither prominent nor slender 3
 - 3a. Claw $> \frac{1}{4}$ the width of the lip; blade reniform, lateral lobes reflexed *S. picta*
 - 3b. Claw $< \frac{1}{4}$ the width of the lip; blade subpandurate, with 2 teeth in front of callus *S. brownii*
- 1b. Lip without claw 4
 - 4a. Lateral sepals free or shortly connate, lip suborbicular *M. macrobulbon*
 - 4b. Lateral sepals ca. $\frac{1}{2}$ connate; lip obovate 5
 - 5a. Inflorescence about as long as the leaves or shorter, callus prominently 2-lobate, with a reddish brown band at the base of the lip *S. hymenantha*
 - 5b. Inflorescence much longer than the leaves, callus obscurely 3-lobate, lip without band at base *S. adamsii*

Sigmatostalix adamsii Dodson, Selbyana 2:54–56. 1977. TYPE: Ecuador, Pichincha, Santo Domingo, 650 m, *Dodson et al.* (holotype: SEL). Figure 46A.

Plant a caespitose epiphyte 12–15 cm high. Rhizome short; roots to 1 mm in diameter. **Pseudobulbs** elliptic-ovoid, compressed, 1.5–3 cm long, 1.3–1.5 cm wide, subtended by 2–3 foliaceous bracts, apically 1-foliate. **Leaves** subcoriaceous, linear-lanceolate, carinate beneath, acute, 10–15 cm long, 1–1.3 cm wide. **Inflorescence** a lateral, slender, many-flowered panicle longer than the leaves, 15–20 cm long including the scape; ovary with pedicel 5 mm long subtended by numerous membranaceous, obovate bracts. **Flowers** white to yellow, the lip yellow, column white. **Sepals** dissimilar,

membranaceous, concave, ovate-lanceolate, acute, 2–2.2 mm long, 0.5–0.6 mm wide, the dorsal free, the laterals at least $\frac{1}{2}$ connate. **Petals** similar to the dorsal sepal, ovate-lanceolate, acute, incurved, 2–2.2 mm long, 0.5–0.65 mm wide. **Lip** sessile, ovate, acute, 3–4 mm long, 1.2–1.5 mm wide; margins undulate. **Column** rather stout for the genus, dilated at the apex, 2 mm long, anther cucullate; pollinia 2, with viscidium and stipe.

An uncommon epiphyte on twigs and smaller branches, usually in disturbed evergreen forests. Ecuador and possibly in Costa Rica, where it has been seen in living private collections.

This species is easily distinguished in Costa Rica by the slender inflorescence with numerous brown bracts at the base of the flowers.

Sigmatostalix brownii Garay, *Caldasia* 10:236. 1968. TYPE: Panama, *Brown* (AMES). Figure 45C.

Plant caespitose or shortly creeping, epiphytic, 12–15 cm high. Rhizome short; roots ca. 1 mm in diameter. **Pseudobulbs** red-brown, ellipsoid-ovoid, compressed, 2–4 cm long, 1–1.5 cm wide, subtended by 2–4 foliaceous bracts when young, apically 1(2)-foliate. **Leaves** subcoriaceous, lanceolate, carinate beneath, 8–15 cm long, 6–10 mm wide, acute. **Inflorescence** lateral, many-flowered, a condensed panicle with primary branches with a single flower, appearing as a raceme, 8–15 cm long including the scape, subtended by a membranaceous, obovate bract; ovary with pedicel 2 mm long subtended by 2 or more bracts. **Flowers** pale green; sepals with red-brown, transverse bars (especially the laterals), lip purplish red. **Sepals** subequal, oblong to lanceolate, carinate, 3–3.3 mm long, 1–1.5 mm wide, acute and apiculate; dorsal concave; lateral sepals recurved and subfalcate; margins undulate. **Petals** lanceolate, falcate, 2.5–2.8 mm long, to about 1 mm wide, acute. **Lip** elliptic-ovate, 2.5–3 mm long, 2–2.3 mm wide; margins undulate; callus on lower $\frac{1}{2}$, fleshy, massive, with two projecting teeth in front. **Column** erect, dilated apically, 2 mm long; pollinia 2, with clavate stipe and viscidium.

Uncommon epiphytes on twigs and smaller branches, usually in disturbed evergreen forests at 50–600 m. Flowering September to December. Costa Rica and western Panama.

Sigmatostalix hymenantha Schltr., *Beih. Bot. Centralb.* 36:419. 1918. TYPE: Costa Rica, Curillo, 300 m *Wercklé* (AMES, a drawing). Figure 45D.

Plant caespitose, epiphytic, 12–18 cm high. Rhizome short; roots to 1 mm in diameter. **Pseudobulbs** ellipsoid-ovoid, compressed, 1.5–3.5 cm long, 1.5–2 cm wide, subtended by 2–4 foliaceous bracts, apically 1-foliate. **Leaves** subcoriaceous, linear-lanceolate, carinate beneath, 10–24 cm long, 4–13 mm wide, acute. **Inflorescence** a lateral, many-flowered panicle about as long as the leaves, 4–20 cm long including the scape; ovary with pedicel 5 mm long, subtended by numerous membranaceous, obovate bracts. **Flowers** white to yellow, the lip darker yellow with red band at the base of the callus, column white. **Sepals** similar, membranaceous, concave, ovate-lanceolate, acute 3–3.3 mm long, 1–1.1 mm wide; the dorsal free, the laterals strongly connate at the base. **Petals** similar to the sepals, ovate-lanceolate, concave, 3–3.2 mm long, 1–1.1 mm wide, acute. **Lip** sessile, suborbicular to subquadrate, reflexed, 3–3.2 mm long, 1.2–1.5 mm wide, acute; margins undulate; callus fleshy, elevated, transversely 2-lobate, concave, the cavity containing an oil in live plants. **Column** stout, dilated apically, 1.5–2 mm long; anther cucullate; pollinia 2, with stipe and viscidium. **Capsule** globose, ca. 5–6 mm long, pedicel ca. 5 mm long.

An epiphyte on twigs and smaller branches, usually in disturbed evergreen forests at (50)350–

950 m; often seen growing on citrus, hibiscus, and coffee. Flowering December to May. Costa Rica, Panama, and South America.

Sigmatostalix hymenantha is easily distinguished by the paniculate inflorescence with a cluster of brown bracts at the base of each flower.

Sigmatostalix macrobulbon Kraenzl., *Pflanzenr.* 80:307. 1922. TYPE: Costa Rica, *Endres* (w). Figure 45B.

Plant caespitose, epiphytic. Rhizome short; roots white, to 1 mm in diameter. **Pseudobulbs** elliptic-ovate, strongly compressed, 3–3.5 cm long, 1–1.5 cm wide, subtended by 2–3 foliaceous bracts when young. **Leaves** subcoriaceous with conduplicate petioles; blade linear-lanceolate to elliptic, carinate beneath, 6–15 cm long, 6–17 mm wide, acute. **Inflorescence** a lateral, many-flowered raceme much longer than the leaves, 5–20 cm long including the scape; ovary with pedicel 5 mm long subtended by a membranaceous, obovate bract. **Flowers** greenish, pale, or bright yellow, the lip with orange-yellow callus, the column white. **Sepals** dissimilar, membranaceous, the dorsal free, erect, ovate-lanceolate, 3 mm long, 1.5 mm wide, concave at the base, apiculate at the apex; lateral shortly connate, strongly reflexed, ovate-lanceolate, 3.5–4 mm long, 1.5–1.7 mm wide, carinate beneath, apiculate. **Petals** elliptic-ovate, 3.5–4.2 mm long, 2–2.2 mm wide, acuminate, with the margins undulate and strongly recurved. **Lip** sessile, suborbicular to subquadrate, strongly convex, 3–3.2 mm long, 5–5.1 mm wide, the apex emarginate, the margins undulate; callus on lower $\frac{1}{3}$ fleshy, elevated, round with a triangular cavity containing an oil in the live plant. **Column** elongate, dilated at the apex, 4 mm long; anther cucullate; pollinia 2, with stipe and viscidium. **Capsule** ellipsoid, ca. 5 mm long; pedicel about 7 mm.

Epiphytic in tropical lowland and premontane rain forests at (400)850–1700 m, where it usually grows on smaller branches in windy habitats. Flowering September to February. Costa Rica and Panama.

Sigmatostalix macrobulbon can be easily distinguished by the flowers, which have a strongly convex lip with fleshy, muffin-shaped callus with triangular cavity. When held under water, the oil droplets within the cavity float to the surface.

Sigmatostalix picta Rchb. f., *Ann. Bot. Syst.* 6: 859. 1864. TYPE: Ecuador, Quito, *Jamieson* (w). ?*S. costaricensis* Rolfe, *Bull. Misc. Inform.* 78. 1916. *S. poikilostalix* Kraenzl., *Pflanzenr.* IV. 50(Heft 80):310. 1922. TYPE: Costa Rica, *Endres* 38, 97 (syntypes: w). Figure 45A.

Plant caespitose, epiphytic. Rhizome short; roots 1–1.2 mm in diameter. **Pseudobulbs** oblong, compressed, 2–3 cm long, 1–2 cm wide, subtended by 2–4 foliaceous bracts,

apically 1-foliate. **Leaves** with blades oblong-lanceolate to elliptic, keeled abaxially, 1.5–13 cm long, 0.7–2 cm wide, acute. **Inflorescence** a slender, lateral, many-flowered raceme or condensed panicle with single-flowered primary branches, to 30 cm long; ovary with pedicel 8 mm long. **Flowers** yellow with brown marks on sepals, petals, and lip; lip apical margin yellow. **Sepals** ovate-lanceolate, reflexed, 8–11 mm long, 2–3 mm wide, acute; dorsal free, the lateral shortly connate. **Petals** similar to the sepals, ovate-lanceolate, reflexed, 8–10 mm long, 2–2.2 mm wide, acute. **Lip** spreading, clawed; blade anchor-shaped, somewhat convex, 7–7.2 mm long, 7–7.2 mm wide, apex shallowly emarginate, apiculate; lateral lobes recurved; callus erect, with 3 more or less rounded teeth. **Column** elongate, arcuate, apically dilated, 6 mm long; anther cucullate; pollinia 2, oblong with elongate stipe and viscidium. **Capsule** ellipsoid, 1–1.5 cm long with beak, pedicel 3–4 mm long.

Epiphytic and uncommon in evergreen forests at 500–1800 m. Flowering August to February. Reported from Nicaragua to South America.

Sigmatostalix picta is easily distinguished by the relatively large, red and yellow flowers with long claw and recurved lateral lobes. As used here, the name represents a complex of species in need of revision. In a narrower sense, *S. picta*, based on Ecuadorian material, may apply to any of several South American species with differing color patterns, in which case *S. costaricensis* Rolfe is probably the next available name. *Sigmatostalix guatemalensis* Schltr. may be a later synonym (1911) but differs in flower color, which lacks red pigmentation.

Sigmatostalix unguiculata C. Schweinf., Bot. Mus. Leaff. 8:55–57. 1940. TYPE: Costa Rica, Province of San José, vicinity of El General, *Skutch 3020* (holotype: AMES). Figure 44D.

Plant caespitose, epiphytic, to 15 cm high. Rhizome short; roots flexuous, to 1 mm in diameter. **Pseudobulbs** ellipsoid to ovoid, compressed, 1.2–2 cm long, 1.2–2 cm wide, subtended by 8–10 foliaceous bracts, apically 1-foliate. **Leaves** subcoriaceous, linear-oblong to elliptic, carinate beneath, 4–7 cm long, 5–8 mm wide, apically 2-lobate. **Inflorescence** a lateral, many-flowered raceme about as long as the leaves, 6–7 cm long including the scape; ovary with pedicel 7 mm long. **Flowers** small, spreading, yellow to yellow-green. **Sepals** similar, reflexed, membranaceous, ovate-lanceolate, acute, 5.8–6

mm long, 1.8–2 mm wide, acute; dorsal free; lateral slightly oblique. **Petals** similar to the sepals, ovate-lanceolate, oblique, 5.8–6 mm long, 1.8–2 mm wide, acute. **Lip** long unguiculate, the claw linear, the blade 3-lobate, abruptly deflexed, 6–6.1 mm long, 2–2.1 mm wide; lateral lobes falcate and hornlike, fleshy, pubescent; callus fleshy, 2-lobate at the intersection of the 3 lobes and containing an oil. **Column** slender, elongate, arcuate, dilated apically, 5 mm long; anther cucullate; pollinia 2, with stipe and viscidium.

Epiphytic and rare in evergreen forests at 500–975 m. Flowering October to December. Apparently endemic to Costa Rica.

Sigmatostalix unguiculata is easily recognized by the long, slender claw and the arcuate, narrow, porrect, lateral lobes of the lip.

Systeloglossum Schltr.

(D. E. Mora de Retana)

REFERENCE—R. L. Dressler and N. H. Williams, The genus *Systeloglossum*. Amer. Orch. Soc. Bull. 39:323–329. 1970.

Epiphytic, caespitose, or rhizomatous and somewhat creeping herb. **Pseudobulbs** present, strongly compressed, subtended by 3–4 foliaceous sheaths; apex 1-foliate. **Leaves** and foliaceous sheaths subcoriaceous, conduplicate. **Inflorescence** a raceme or panicle with primary branches. **Flowers** green, yellowish, or suffused with purple. **Sepals** dissimilar; dorsal concave; lateral connate and adnate to the column foot apically as well as laterally. **Petals** united laterally to base of lateral sepals. **Lip** simple, united with column foot forming a nectary; blade unguiculate, suborbicular to ovate, with simple calli usually of a pair of swellings. **Column** stout with broad wings; pollinia 2 supported on a squarrose stripe and viscidium (Costa Rican species). **Fruit** a capsule.

A Neotropical genus of five species native to rain forests from Costa Rica (two species) to Andean South America.

Systeloglossum forms a rather isolated group with *Diadenium* and *Oliveriana*. No evidence from DNA studies is available to link this group with others.

Key to the Species of *Systeloglossum*

- 1a. Column foot about as long as column; floral bracts 5–6 mm long; pseudobulbs hidden by subtending foliaceous sheaths. *S. acuminatum*
- 1b. Column foot much shorter than column; floral bracts 2–4 mm long; pseudobulbs clearly visible *S. costaricense*

Systeloglossum acuminatum Ames & C. Schweinf., Sched. Orch. 10:105–106. 1930.
TYPE: Costa Rica, La Estrella, *Lankester 1091* (holotype: AMES, photo seen). Figure 46B.

Plant epiphytic, caespitose to somewhat repent; rhizome segments 3–5 cm long per shoot; roots ≤ 2 mm in diameter. **Pseudobulbs** cylindric, narrow, smooth, compressed, 2–2.6 cm long, ca. 5 mm wide, usually concealed and subtended by 3–7 oblong-lanceolate foliaceous bracts; apex 1-foliate. **Leaf** linear-elliptic, base conduplicate, thin, 8–25 cm long, 0.6–1.5 cm wide; apex asymmetric, attenuate. **Inflorescence** lateral, a raceme or few-branched panicle, 10–30 cm long including scape, successively flowered; ovary with pedicel ca. 1 cm long, subtended by an acuminate floral bract 5–6 mm long. **Flowers** green. **Sepals** somewhat fleshy, dissimilar; dorsal oblong-elliptic, adnate to the base of the petals, 9–12 mm long, 3–4 mm wide, apex obtuse and thickened; lateral sepals connate forming an abaxially 2-keeled, elliptic-ovate, deeply emarginate synsepal 1.1–1.8 cm long, 4–6 mm wide, united to the end of the column foot. **Petals** adnate to the base of sepals, triangular-lanceolate, carinate, lightly reflexed, 7–8 mm long, 4 mm wide, acute. **Lip** shortly unguiculate, forming a broad nectary with foot, adnate to base of column; blade suborbicular, convex, ca. 6 mm long, 6 mm wide, emarginate; callus of 2 semiglobose protuberances below the middle. **Column** erect, fleshy, with broad, crenulate wings apically, 3 mm long, 7 mm including foot; foot 4 mm long; pollinia 2, fleshy, translucent, with squarrose stipe and viscidium. **Capsules** ellipsoid, 2–3.5 cm long including beak, pedicel ca. 1 cm long.

Epiphytic in montane rain forests at 1100–2000 m. Flowering October to April, perhaps throughout the year. Endemic to Costa Rica.

Systeloglossum acuminatum is distinguished from *S. costaricense* Schltr. by the smaller pseudobulb, the somewhat longer column foot, and the less dense inflorescence with longer acuminate floral bracts. Plants and flowers of *S. acuminatum* are less suffused with brown or purple, and the leaves are generally more slender.

Systeloglossum costaricense Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:252–253. 1923.
TYPE: Costa Rica, Alto de Santiago de San Ramón, *Brenes 19* (drawing of type: AMES). Figure 46C.

Plant epiphytic, caespitose to distinctly repent; rhizome segments ≤ 3.5 cm long per shoot; roots ≤ 2.5 mm in diameter. **Pseudobulbs** conspicuous, elliptic to ovate, smooth, strongly compressed laterally, 3–7 cm long, 1–2.1 cm wide, subtended by 3–6 oblong-lanceolate foliaceous bracts; apex 1-foliate. **Leaf** brownish or purplish green, conduplicate at the base; blade thin, 8–25 cm long, 1–2.4 cm wide, oblong-lanceolate; apex asymmetric, acute. **Inflorescence** a lateral panicle with

1 or more fractiflex, densely and successively flowered primary branches, 15–35 cm long including the peduncle; ovary with pedicel 1–1.3 cm long, subtended by subulate bracts 2–4 mm long. **Flowers** green or brownish, ca. 2.2 cm high, 1.3 cm wide. **Sepals** somewhat fleshy, dissimilar; dorsal elliptic, obtuse, 9–13 mm long, 4 mm wide; lateral connate forming an abaxially 2-keeled, elliptic-ovate, emarginate synsepal 1–1.8 cm long, ca. 5 mm wide. **Petals** adnate to base of sepals, triangular-lanceolate, carinate, lightly reflexed, ca. 9 mm long, 3 mm wide. **Lip** obovate, convex, lightly retuse, apiculate, ca. 6–7 mm long, 4–5 mm wide; callus of 2 rounded pads near the middle. **Column** erect, fleshy, broad, 5–6 mm long, forming a nectary at the base; foot 2–3 mm long; apex with a pair of concave wings; anther papillose; pollinia 2, fleshy, translucent, with intensely red squarrose stipe and viscidium.

Epiphytic in lowland tropical and premontane rain forests at (50)750–1300 m. Flowering mostly January to April, September, and perhaps throughout the year. Endemic to Costa Rica.

Systeloglossum costaricense differs from *S. acuminatum* Ames & C. Schweinf. in the more exposed pseudobulb, more densely flowered inflorescence branches with shorter, subulate floral bracts, the column foot less than half the column length, the tendency for broader leaves, and the plants suffused with purple or brown.

Ticoglossum Halb.

(D. E. Mora de Retana)

REFERENCE—F. Halbinger, *Cymbiglossum*, *Ticoglossum*, and *Rhynchostele*. Orquídea (Méx.) 8: 155–282. 1983.

Epiphytic, caespitose to rhizomatous **herb**, roots grayish, somewhat velvety. **Pseudobulbs** compressed, ancipitous, discoid to ovoid, subtended by 2–4 foliaceous bracts; apex 1-foliate. **Leaves** conduplicate, elliptic-lanceolate, petiolate, acute. **Inflorescence** a lateral, scapose raceme borne at the base of the pseudobulb, with 1–5 flowers; ovaries terete, pedicellate, subtended by ovate, acute floral bracts. **Flowers** showy, white or rose. **Sepals** elliptic to ovate, apiculate. **Petals** subequal to the sepals, usually with a short, wide claw. **Lip** free, with claw and a fleshy callus. **Column** stout, straight; pollinia 2, conic-reniform, with stipe and viscidium. **Fruit** an ellipsoid capsule.

A small genus of but two recognized species, both occurring in Costa Rica. Chase and Palmer suggest that *Ticoglossum* is related to the *Lophiarris* clade (mule ear oncidiums) of subtribe Oncidiinae and especially to *Palumbina* and *Rossioglossum*.

Key to the Species of *Ticoglossum*

- 1a. Pseudobulbs strongly compressed with sharp edges, inflorescence with 2–5 white or pink flowers *T. krameri*
- 1b. Pseudobulbs thick with rounded edges; inflorescence with 1–2 white flowers *T. oerstedii*

Ticoglossum krameri (Rchb. f.) Rodriguez ex Halb., Orquídea (Méx.) 9:5. *Odontoglossum krameri* Rchb. f., Gard. Chron. 98, t. 1868. TYPE: Costa Rica, *Kramer sub Veitch* (holotype: w, photo seen). The following names are based on white-flowered specimens (types not seen). *Ticoglossum krameri* var. *smithianum* (Rchb. f.) E. A. Christenson, Lindleyana 6:47. 1991. *Odontoglossum krameri* var. *smithianum* Rchb. f., Gard. Chron. 19(ser. 1):242. 1883. *Odontoglossum krameri* var. *album* Rolfe, Orch. Rev. 1:200. 1893. *Ticoglossum krameri* var. *album* (R. L. Rodr. C. ex Halb.) Halb. *Odontoglossum krameri* var. *album* R. L. Rodr. C. ex Halb. Orquídea (Méx.) 8: 186. 1982. Figure 46D.

Plant epiphytic, caespitose to 25(30) cm high. Rhizome short; roots to 2 mm in diameter. **Pseudobulbs** ovate-elliptic, strongly compressed laterally edges sharp, 3–5 cm long, to 4 cm wide, subtended by 3–4 subulate, nonfoliaceous bracts, 1-foliate apically. **Leaves** coriaceous, the base with petiole to about 4–5 cm long; blade elliptic-oblong, 13–22(28) cm long, 1.5–4 cm wide, the apex acute, somewhat apiculate. **Inflorescence** a lateral raceme of 2–4(5) flowers, 20–25 cm long including the scape; ovary with pedicel (3.5)4–5 cm long. **Flowers** white or light lavender with yellow callus, the dorsal sepal with yellow spot at the base. **Sepals** subequal, sessile, elliptic-ovate, apiculate, 1.3–1.7 cm long, 5–7 mm wide. **Petals** elliptic-oblong, united to the base of the column with a short, broad claw, 1.5–2 cm long, 8–10 mm wide; apex obtuse, lightly apiculate. **Lip** suborbicular to trapezoid, somewhat concave, about 1.5 cm long, 1.4 cm wide; apex emarginate; callus basal, somewhat elevated, base with 2 projections, apex with 2 teeth. **Column** stout, 8–9 mm long, somewhat broadened apically, without wings, but variously auriculate; pollinia 2, ovate, waxy, with stipe and viscidium. **Capsule** ellipsoid, without beak, 5 cm long, pedicel 3 cm long.

Epiphytic in premontane and montane cloud forests at 850–1100 m, but Halbinger reports 600–1200 m. Flowering February to September and November. Costa Rica; also reported from Nicaragua and Panama.

This species is easily distinguished from higher-elevation *T. oerstedii* (Rchb. f.) R. L. Rodriguez ex Halb. by the usually 3–5-flowered inflorescence and flowers with lip usually shorter than the sepals. Even when not in flower, the strongly

ancipitous pseudobulbs and relatively short petiole easily distinguish *T. krameri* from *T. oerstedii*.

Ticoglossum oerstedii (Rchb. f.) R. L. Rodr. C. ex Halb., Orquídea (Méx.) 9:5. 1983. *Odontoglossum oerstedii* Rchb. f., Bonplandia 3:214. 1855. TYPE: Costa Rica, Volcán Irazú, Warscewicz 689 (holotype w, photo seen). Figure 47A.

Plant epiphytic, occasionally terrestrial, caespitose herbs. Rhizome short; roots to 2 mm in diameter. **Pseudobulbs** ovoid, suborbicular, thick 1–3.5 cm tall, 1–1.5 cm wide, subtended by 2–4 nonfoliaceous bracts, apically 1-foliate. **Leaves** with petiole to ca. 1/2 the blade length; blade coriaceous, elliptic, acute, strongly keeled abaxially, 3–13 cm long, 1–3 cm wide. **Inflorescences** lateral, with 1 (rarely to 3) flowers, the scape 2–5 cm tall; ovary with pedicel 3–5 cm long, much longer than the subtending acute floral bract 6–12 mm long. **Flowers** white, callus spotted with orange, lip with orange in front of callus. **Sepals** similar, elliptic, 9–16(20) mm long, 6–9 mm wide, acute to obtuse. **Petals** obovate, obtuse, 1–1.7(1.9) cm long, 5–8(14) mm wide. **Lip** basally adnate to the column, obovate-flabellate, cuneate, deeply emarginate, 2–2.5(2.7) cm long, 1.2–1.6(1.8) cm wide, with an elevated W-shaped callus, the central point pubescent. **Column** stout, 6 mm long; pollinia 2, with long stipe and viscidium. **Capsule** ellipsoid, with short beak, 2–2.5 cm long with pedicel 1.8–3 cm long.

Epiphytic in premontane and lower montane rain forests at 1400–3000 m, where it grows on somewhat shaded median branches or in duff in deep shade beneath bamboos. Flowering throughout the year. Costa Rica; also reported from Panama.

Ticoglossum oerstedii differs from related *T. krameri* (Rchb. f.) R. L. Rodr. C. ex Halb. in the less compressed pseudobulbs, long petiolate leaf, and the single (rarely two), differently shaped flowers of the inflorescence. Flower size is extremely variable. One herbarium specimen (AMES 32911) includes one flower more than 5 cm tall. Apparently there is little or no overlap in the vertical distribution of the two species.

Trichocentrum Poeppig & Endl.
(F. Pupulin & D. E. Mora de Retana)

Herb a caespitose epiphyte with reduced rhizomes. **Pseudobulbs** usually inconspicuous, ovoid to suborbi-

cular, generally concealed by scarious bracts. **Leaves** single, occasionally in pairs, articulate, sessile, coriaceous to fleshy, ovate, oblong-elliptic to ligulate. **Inflorescence** a lateral raceme or few-branched panicle with 1-many flowers, often successive. **Flowers** often large, showy, and sometimes fragrant. **Sepals** and **petals** free, similar, spreading. **Lip** adnate to the column base producing a conic or gibbous spur; blade with or without calli or lobules near the base. **Column** short, stout, adnate to the lip, auriculate or winged above, without a foot; pollinia 2, on a triangular stipe with reflexed margins. **Fruit** a capsule.

Key to the Species of *Trichocentrum*

- 1a. Spur conic or cylindric, not lobed. 2
 - 2a. Spur > 5 mm long; column wings with longitudinal brown stripes *T. dianthum*
 - 2b. Spur < 5 mm long; column wings white with brown spots on margins 3
 - 3a. Lip flabellate, with very crisped apical margin; lateral lobes of lip digitate *T. pfavii*
 - 3b. Lip cuneate, somewhat obovate, fleshy and with plain apical margin; lateral lobes short and rounded *T. estrellense*
- 1b. Spur 2- or 4-lobed 4
 - 4a. Anther cap glabrous *T. caloceras*
 - 4b. Anther cap papillose or hirsute. 5
 - 5a. Column wings obtuse with incurved apices *T. costaricense*
 - 5b. Column wings with ascending or porrect apices, acute, usually somewhat revolute, never incurved 6
 - 6a. Inflorescence erect to spreading, flowers small, tepals \leq 6 mm long; lip lightly narrowed in the middle *T. brenesii*
 - 6b. Inflorescence pendent, flowers medium to large, tepals \geq 15 mm long, lip never narrowed in the middle 7
 - 7a. Lip shorter than sepals, elliptic-ovate *T. capistratum*
 - 7b. Lip longer than sepals, broadly rhombic *T. cymbiglossum*

Trichocentrum brenesii Schltr., Repert. Spec. Nov. Regni Veg. Beih. 19:248. 1923. TYPE: Costa Rica, San Pedro de San Ramón, 1200 m, *Brenes 116* (drawing: AMES). Figure 48C.

Plant epiphytic, small, to ca. 10 cm high. Rhizome short; roots filiform, flexuous, glabrous. **Pseudobulbs** nearly obsolete, scarcely 3 mm long, 1-foliate. **Leaf** suberect, obliquely ligulate, subacute, abruptly subpetiolate-narrowed toward the base, to 9 cm long, 1.5 cm wide. **Inflorescence** single, erect-spreading or spreading, with a single flower; peduncle concealed by a few sheaths at the base, the rest naked; ovary with pedicel glabrous, 1.2 cm long, floral bract ovate, shortly acuminate, $\leq \frac{2}{3}$ as long as the ovary. **Flowers** generally small, glabrous, thin in texture. **Sepals** ligulate, acute, 3-nerved, 6 mm long; lateral sepals oblique. **Petals** obliquely ligulate, somewhat acute, 3-nerved, 5 mm long. **Lip** oblong, subobtuse, somewhat narrowed in the middle, rounded at the base, smooth, glabrous, with short subtruncate spur 6 mm long, 2.75 mm wide at the base, 3.25 mm wide above the middle. **Column** short, 2 mm long, with 2 upward, obliquely subfalcate-elliptic, apiculate, entire

A Neotropical genus of about 25 species distributed from southern Mexico to Brazil, Bolivia, and Peru. Ten species are reported from Central America, eight of which occur in Costa Rica.

Cladistic analysis of data based on DNA (Chase & Palmer, 1992) strongly suggests close relationships within the *Lophiaris* clade, including *Oncidium* sect. *Cebolletae* Lindl. and *O.* sect. *Pluriturberculata* Lindl.

wings; anther dorsally densely papillose-verruculose, rounded-cucullate.

Epiphytic in the moist premontane forest of Cordillera de Tilarán, San Ramón, and San Jerónimo at 1000–1200 m. Flowering time incompletely known; at least September (type). Endemic to Costa Rica, where it has been collected only three times. The above description is translated from Schlechter's original.

Although the type of *T. brenesii* was destroyed, a copy of Schlechter's drawing is kept at AMES and clearly shows the critical characters of the species: the lip slightly narrowed in the middle, not emarginate, and not longer than the sepals; the narrow sepals; and the apiculate column wings. Lip shape should prevent any confusion with *T. capistratum*, which has an elliptic-ovate, concave, carinate lip with undulate margins, whereas *T. brenesii* has a perfectly flat lip, lacking any keel or callosity.

Trichocentrum caloceras Endres & Rchb. f., Gard. Chron. 1257. 1871. TYPE: Costa Rica, Endres, not found (neotype: USJ *Pupulin* & *Castelfranco* 1; designated in Lindleyana 10:188. 1995). Figure 48A.

Plant a caespitose, pendent epiphyte. Rhizome short; roots filiform, glabrous. **Pseudobulbs** minute, rounded, 1-foliate, 2–2.5 mm long. **Leaf** fleshy, green spotted with purple, sessile, oblong to oblong-elliptic, 7 cm long, 1.4 cm wide, bluntly acute, somewhat minutely mucronate. **Inflorescence** a raceme 3–3.5 cm long including the terete scape and short, zigzag rachis, successively 5–6-flowered; floral bracts conspicuous, imbricate, ovate, cucullate, 4 mm long, acute; ovary with pedicel 8–10 mm long. **Flowers** small, spreading, with yellowish brown tepals; lip white marked with large purple blotches; anther white. **Sepals** dissimilar, elliptic-lanceolate, bluntly acute; dorsal erect, slightly concave, 1.1 cm long, 4 mm wide; laterals somewhat oblique, 1.2 cm long, 3 mm wide, apically carinate. **Petals** oblong-elliptic, obtuse, 1.2 cm long, 4–5 mm wide. **Lip** ovate-pan-durate, adnate to the column base, carinate, 1.6 cm long, 8 mm wide; base cuneate forming a short, subquadrate, thickened spur of 4 lobes; apex retuse; callus of 2 thick keels converging at the base. **Column** 5 mm long, with 2 fleshy, rhombic, concave wings with revolute margins; anther cucullate, glabrous; pollinia 2, pyriform, with elongate, triangular stipe and a brown, peltate viscidium.

Trichocentrum caloceras grows either on twigs or on larger, shadier branches in premontane cloud forests at 900–1300 m. Flowering generally May to July. Southeastern Costa Rica and Panama.

Trichocentrum caloceras may be easily distinguished from its other Costa Rican relatives by the glabrous anther.

Trichocentrum capistratum Linden & Rchb. f., Gard. Chron. 1257. 1871. TYPE: Costa Rica, Wallis (w). *Trichocentrum panamense* Rolfe, Bull. Misc. Inform. 341–342. 1913. TYPE: Panama, Canal Zone, *Lipscomb* s.n. (K). *Trichocentrum pusillum* Lehmann, name only (K, MS). Figure 48D.

Plant epiphytic, pendent, caespitose. Rhizome short; roots slender, to about 1 mm in diameter. **Pseudobulbs** very short, 1-foliate. **Leaf** fleshy, oblong-lanceolate to elliptic-lanceolate, 4–7 cm long, 2 cm wide, gradually narrowed to a conduplicate, sessile base, apex acute. **Inflorescence** a pendent raceme of 3–7 successive flowers, 2–4 cm long including the zigzag rachis; ovary with pedicel 5–7 mm long, subtended by concave, triangular, acute bracts to 1.5 mm long. **Flowers** small with sepals and petals pale green or greenish yellow and lip white marked near the base with 2–4 reddish brown blotches. **Sepals** subequal, free, spreading, subcarinate, oblong-elliptic to elliptic, 1.6–1.8 cm long, 3–4 mm wide, acute.

Petals oblong-elliptic, 1.4–1.6 cm long, 4–5 mm wide, acute. **Lip** adnate to the column, elliptic-ovate, concave, carinate, 1.6 cm long including spur, ca. 9 mm wide, with a short, obscurely 4-lobate, dorso-ventrally flattened spur at the base, acute, the basal margins somewhat undulate. **Column** short, stout, ca. 5 mm long, with a pair of portect, fleshy, subquadrate, acute wings; anther cucullate, hirsute; pollinia 2, pyriform, compressed-concave; stipe flat, elongate, triangular; viscidium peltate, brown.

Trichocentrum capistratum is found in lowland and premontane evergreen forests at 500–1000 m, often growing low on twigs with roots in dense moss. It sometimes is found in bright light on the very smooth and dry bark of *Psidium guayava*. Plants have been observed in flower April to June, August, October, and November; to be expected throughout the year. Costa Rica to Colombia and Venezuela.

This species, while variable in leaf size and shape as well as scape length, is easily distinguished from similar *T. caloceras* and *T. costaricense* by the lack of spots on the lip and the presence of conspicuous trichomes on the anther.

Trichocentrum costaricense Mora-Retana & Pupulin, Sebyana 15(2):94. 1994. TYPE: Costa Rica, Alajuela, near Ciudad Quesada, about 700 m, *Horich* s.n. (holotype: USJ). Figure 48B.

Plant epiphytic, caespitose, pendent. Rhizome short; roots filiform, glabrous. **Pseudobulbs** short, rounded, caespitose, 1-foliate, ca. 3 mm long. **Leaf** fleshy, from a cuneate base, obovate-elliptic to elliptic-lanceolate, acute, sessile, 4 cm long, 1.7 cm wide. **Inflorescence** a raceme with green, terete peduncle, 2–3 cm long; rachis abbreviated, producing 2–3 flowers consecutively; ovary with pedicel linear-clavate, 8–10 mm long; floral bracts distichous, short, ovate, cucullate, 2 mm long, acute. **Flowers** spreading; tepals greenish white, lip white with lilac spots. **Sepals** similar, subcarinate, to 14 mm long; dorsal erect, obovate-oblong, acute to acuminate, 4 mm wide; lateral spreading, obliquely linear-lanceolate, acute, 2–2.5 mm wide. **Petals** obovate-oblong, 13 mm long, 4 mm wide, obtuse to acute. **Lip** elliptic, adnate to the column, concave, obtuse to retuse, carinate apically, 1.6 cm long, 10 mm wide, producing with the column base a short, flattened, truncate, obscurely 2–4-lobed spur; callus consisting of a pair of obscure keels toward the base. **Column** short, stout, without a foot, ca. 5 mm long, with a pair of fleshy, incurved, subfalcate, obtuse wings; anther white, cucullate, papillose; pollinia 2, pyriform, concave, with elongate, triangular stipe; viscidium peltate, brown.

Epiphytic in the premontane rain and wet forests of Cordillera de Tilarán, both along the Central Pacific watershed and the Río San Carlos drainage. *Trichocentrum costaricense* is generally

found on shady, constantly moist trunks and inner branches. Flowering October to January. Endemic to northern Costa Rica.

Trichocentrum costaricense differs from *T. capistratum* and *T. caloceras* in the fine purple spotting of the lip and in the incurved, obtuse, subfalcate wings of the column. The only other Costa Rican species with purple lip color is *T. caloceras*, which has an obovate-subpandurate lip, revolute margins of the column wings, and glabrous anther cap. Both *T. capistratum* and *T. caloceras* are more southerly species.

Trichocentrum cymbiglossum Pupulin, Lindleyana 9:51. 1994. TYPE: Costa Rica, Alajuela, Laguna Bosque Alegre, 750 m, *Pupulin* 5 (holotype: USJ). Figure 49A.

Plant epiphytic, caespitose. Rhizome short; roots filiform, glabrous. **Pseudobulbs** minute, rounded, 1-foliate, about 4 mm long. **Leaf** dark green, fleshy, sessile, linear-elliptic to elliptic, 5.3–7.5 cm long, 1.7–2.5 cm wide, obtuse to acute. **Inflorescence** a pendent raceme to 7 cm long; rachis short, zigzag, of 1–7 successively borne flowers; ovary with pedicel 4–7 mm long; floral bracts papery, distichous, ovate, cucullate, 6–7 mm long, acute. **Flowers** rather large, to 4.2 cm in diameter; tepals greenish white, free, spreading; lip white. **Dorsal sepal** elliptic-lanceolate, subcarinate, 1.5–1.9 cm long, 3–5 mm wide; apex acute, somewhat recurved; lateral sepals obliquely subfalcate, somewhat shorter than dorsal sepal, 1.35–1.8 cm long, 3 mm wide, acute. **Petals** oblanceolate-oblong, 1.87 cm long, 4.2–5 mm wide, apex acute and subcarinate. **Lip** adnate basally to the column, concave, carinate, broadly rhombic, 2–2.6 cm long including the short, flat, truncate, 4-lobed spur, 1.8 cm wide at the middle, apex retuse, margins undulate. **Column** stout, ca. 5 mm long, with a pair of erect-spreading, triangular, acute wings, apical margins erose; anther cucullate, white, papillose; pollinia 2, pyriform, concave, supported on a short triangular stipe; viscidium peltate, brown.

Usually epiphytic in medium or deep shade in very moist sites on small branches or trunks covered by dense moss mats in evergreen forests at 600–750 m. Flowering September to November. Endemic to Costa Rica; Atlantic drainage of northern and central Cordilleras and the high basin of the Río Reventazón.

The rhombic, concave lip, which is much longer than the sepals, is unique among species of Costa Rican *Trichocentrum*. Before its description, *T. cymbiglossum* had been accepted as *T. candidum* Lindl. (e.g., Icon. Pl. Trop. 15: t. 1495) but has a rhombic lip among other differences.

Trichocentrum dianthum Pupulin & Mora-Re-tana, Selbyana 15(2):90. 1994. TYPE: Costa Rica, Province of San José, Las Nubes de Quizarrá, 1988, flowered in cultivation March 1989, *J. Cambronero s.n.* (holotype: USJ). Figure 47B.

Plant epiphytic, caespitose, pendent. Rhizome short; roots filiform, glabrous. **Pseudobulbs** minute, rounded, to 5 mm long, 1-foliate. **Leaf** light green, sessile from a conduplicate base, oblong-elliptic to oblong-obovate, to 9.7 cm long, 3 cm wide, apex acute to minutely retuse. **Inflorescence** erect, simple or more commonly branched, 2-flowered in each branch; peduncle terete, green, 3.5–4 cm long; ovary with pedicel 2.3 cm long, linear-clavate; floral bracts conspicuous, ovate, concave, spreading, brownish, to 5 mm long. **Flowers** spreading, with tepals yellow covered by a very large brown blotch; lip white, marked near the base by 2 rose-purple blotches; column wings brown-striped, anther white. **Sepals** dissimilar, carinate; dorsal erect, elliptic-oblanceolate, carinate, to 1.65 cm long, 6.3 mm wide, obtuse to subacute; lateral sepals spreading, obliquely oblanceolate, to 1.7 cm long, 4 mm wide. **Petals** linear-oblong, subcarinate, to 1.65 cm long, 5 mm wide, acute. **Lip** spatulate, adnate to column base, 2.5 cm long, 9.2 mm wide; lateral lobes at base narrow, falcate; midlobe rounded in front and with crisped margins; spur at the base elongate, slender, conic, 1.1 cm long. **Column** short, stout, to 5 mm long, with a pair of fleshy, erect, subquadrate wings; anther cucullate, hirsute; pollinia 2, pyriform, compressed, with short, triangular stipe; viscidium peltate, brown.

Rare epiphyte restricted to 1000–2000 m in the northern part of the Río General Valley, both in the watershed of the Fila Costera and the slopes of the Cordillera de Talamanca, and to the high western intermountain valleys of the Cerro Vuel-tas. Sometimes found on *Citrus* growing in thick moss of shady branches. Flowering February to April. Endemic to Costa Rica.

Trichocentrum dianthum may be easily distinguished by its long, conic spur and the heavy brown striping on the column wings.

Trichocentrum estrellense Pupulin & J. B. García, Lindleyana 10:195–197. 1995. TYPE: Costa Rica, Cartago, El Guarco, along a minor tributary of Río Reventazón, *F. Pupulin* 209 (holotype: USJ). Figure 47D.

Plant epiphytic, caespitose, pendent. Rhizome short; roots filiform, glabrous, silvery white. **Pseudobulb** cylindric, to 10 mm long, 5 mm wide, 1-foliate. **Leaf** light green, sessile from a conduplicate base, linear-elliptic to elliptic-oblong, 8–12(20) cm long, 2.5–3 cm wide, obtuse to retuse. **Inflorescence** pendent, 3–many-flowered, successive, sometimes branched at the base; peduncle terete, 4–11.5 cm long, concealed by 2–3 concave, ovate bracts; ovary linear-clavate, ca. 3 cm long including the pedicel. **Flowers** large for the genus, tepals free, ivory

white with narrow chestnut brown blotch on the lower $\frac{1}{2}$; lip white marked near the base by 2 rose-purple bars; column wing margins spotted and blotched with brown; anther white. **Sepals** dissimilar, obtuse to retuse; dorsal obovate-elliptic, to 1.6 cm long, 8.5 mm wide, slightly concave apically; lateral sepals obliquely elliptic, to 1.6 cm long, 6.5 mm wide, apex subcarinate and slightly concave, with short, rounded apicule. **Petals** linear-elliptic, 1.6 cm long, 6.5 mm wide, slightly concave apically. **Lip** adnate to the column base, obovate-subpandurate, 2.1 cm long, with short linear claw 2 mm long abruptly expanding to the blade, with 2 broad, subquadrate, pubescent basal lateral lobes; apex deeply emarginate; margins smooth, entire, producing with the column base a very short, blunt, saccate spur 2.6 mm long, 3.5 mm wide. **Column** short, stout, 3 mm long, with a pair of short, erect, subfalcate, lacerate wings; anther cucullate, papillose; pollinia 2, pyriform, rugulose, with short triangular stipe; viscidium elliptic, brown.

Epiphytic in premontane or tropical lowland rain forests at 450–1450 m. Known from the Atlantic slopes of Cordillera de Talamanca, where it grows on shady branches and moss-covered trunks mainly over streams. Flowering June to September. Endemic to Costa Rica.

The obovate, fleshy lip with plain apex, the short and rounded lateral lobes, and successive inflorescence distinguish *T. estrellense* from close relatives.

Trichocentrum pfavii Rchb. f., Gard. Chron. (n.s.) 16:70. 1881. TYPE: Chiriquí (probably Panama), *Pfau* 60 (w). *Trichocentrum pfavii* var. *zonale* Rchb. f., Gard. Chron. (n.s.) 19:44. 1883. *Trichocentrum saundersianum* Endres & Rchb. f., name only (w, MS). *Trichocentrum saundersii* Endres & Rchb. f., name only (w, MS). *Trichocentrum zonale* Rchb. f., name only (w, MS). Figure 47C.

Plant epiphytic, caespitose, pendent. Rhizome short; roots slender for the genus, glabrous. **Pseudobulbs** minute, rounded, ≤ 5 mm long, covered by a brown sheath, 1-foliate. **Leaf** light green, fleshy, sessile from a conduplicate base, oblong-elliptic to oblong-ovate, 7.2–12.5 cm long, 1.4–3.8 cm wide, obtuse to retuse. **Inflorescences** 2–4, pendent to suberect, shorter than the leaves, frequently branched at the base, mostly 2-flowered; peduncle terete, ≤ 5.1 cm long, concealed by 2–3 spreading, ovate, concave bracts; ovary linear-clavate, ca. 2 cm long including the pedicel. **Flowers** large and showy, tepals free, spreading, white with large median brown-rose blotch; lip white marked basally by 1–2 rose-purple blotches; anther white. **Sepals** dissimilar, somewhat concave; dorsal elliptic-ovate, to 1.5 cm long, 8 mm wide; apex rounded to emarginate, sometimes with a dorsal apicule; lateral sepals obliquely elliptic-lanceolate, 1.5 mm long, 6 mm wide, subcarinate and thickened through the middle, apex obtuse and minutely apiculate. **Petals** spatulate, to 1.4 cm long, 6 mm wide, obtuse. **Lip** adnate to the column, cuneate-flabellate, 2.2 cm long, 1.6 cm

wide, with cuneate claw 5 mm long, the base with 2 narrow, erect, falcate, pubescent lateral lobes, expanding abruptly to the suborbicular blade, producing with the column base a very short, blunt, saccate spur 3 mm long. **Column** short, stout, ca. 5 mm long, with a pair of large, erect-spreading, subquadrate, rounded wings spotted brown along the margins; anther hemispheric, papillose; pollinia 2, pyriform, on a short, triangular stipe; viscidium peltate, brown.

Epiphytic on small branches with persistent, dense foliage and on moss-covered vines close to water in premontane and lower montane rain forest at 800–1500 m. Flowering November to March. Panama (Chiriquí) to Costa Rica in Valle de Coto Brus and Valle del General and along the Pacific slopes of the Cerro de la Muerte and Cerro Vueltas just to the region of Dota northward.

This species could probably be divided into two geographic races; one distributed from Panama to the northern limits of the Valle del General and the other inhabiting the medium intermountain valleys in the region of Dota. This last race generally presents a markedly narrower lip and a darker, brown color on the tepals.

Trichopilia Lindl.

(D. E. Mora de Retana)

Epiphytic and mostly caespitose **herb**. Rhizome short; roots cylindric, white. **Pseudobulbs** suborbicular, ovoid to linear-oblong, often much compressed, with nonfoliaceous sheaths at the base, apex 1-foliate. **Leaves** coriaceous, conduplicate, elliptic to lanceolate, acute. **Inflorescence** lateral, a raceme or flower solitary. **Flowers** large and often very showy, usually white to yellow variously marked with purple or red. **Sepals** similar, narrow, imbricate in bud, sometimes twisted, the lateral sepals sometimes variously connate to about the middle, margins usually undulate. **Petals** similar to the sepals. **Lip** simple or 3(4)-lobate, shortly adnate to the column, lateral lobes usually inrolled around the column; midlobe usually emarginate; margins often crispate, dentate, or undulate; callus usually with 1–3 keels. **Column** erect, semiterete, the base without a foot, anther bed dentate to fimbriate; pollinia 2, waxy with stipe with viscidium. **Fruit** a capsule.

A Neotropical genus of about 30 species of low to intermediate elevations. Six species are known in Costa Rica. Sterile plants or plants in fruit are usually easily distinguished by the nonfoliaceous, often spotted sheaths at the base of the apically 1-foliate pseudobulbs.

According to Chase, *Trichopilia* is closely related to *Helcia* and *Neoescobaria*, a clade that is somewhat isolated in the Oncidiinae.

Key to the Species of *Trichopilia*

- 1a. Pseudobulbs suborbicular to subquadrate, to at most 2 times as long as wide 2
 - 2a. Inflorescence with a single yellowish white flower *T. maculata*
 - 2b. Inflorescence with 2 or more white flowers with purple spotted lip *T. suavis*
- 1b. Pseudobulbs linear, usually more than 3 times as long as wide 3
 - 3a. Flowers yellowish white, without reddish or brown spots
 - 4a. Flowers 2–5 per inflorescence *T. turialbae*
 - 4b. Flowers usually 1 per inflorescence *T. maculata*
 - 3b. Flowers with brown or reddish spots; sepals free or united only at the base 4
 - 5a. Sepals and petals tinged with brown; lip white with brown spots *T. tortilis*
 - 5b. Sepals and petals white or yellow tinged with red; lip white, lined, tinged, or spotted with red 5
 - 6a. Lip white tinged variously with red and with white margin. *T. marginata*
 - 6b. Lip yellow, with reddish brown, more or less irregular longitudinal spots
..... *T. galeottiana*

Trichopilia galeottiana A. Rich. & Gal., Ann. Sci. Nat. Bot. ser. 3, 3:26. 1845. TYPE: Mexico. (K, photo seen). ?*Trichopilia picta* Lemaire, Ill. Hort. 6:86–87, t. 225. 1859. TYPE: Mexico. Figure 50C.

Plant a compact, caespitose epiphyte, to ca. 30 cm tall. Rhizome short; roots 1–2 mm in diameter. **Pseudobulbs** subcylindric, ancipitous, 8–12 cm long, 1.2–2 cm wide, subtended by grayish bracts becoming papery with age, 1-foliate apically. **Leaves** elliptic-lanceolate, carinate abaxially, 16–25 cm long, 3–5 cm wide, apex acute. **Inflorescences** lateral, pendent, 3–4, each with a solitary flower; ovary with pedicel 2.7 cm long, subtended by 3 papery, obtuse bracts. **Flowers** with greenish yellow sepals and petals with an interrupted reddish brown stain near the midvein; lip yellowish white with reddish brown spots apically and at the base of the lateral lobes, the lamina with a saffron-yellow spot centrally. **Sepals** subequal, elliptic-lanceolate, acute, carinate abaxially, 4.5–5 cm long, 1–1.2 cm wide, acute; dorsal erect, free; laterals shortly connate and recurved. **Petals** similar to the sepals but broader, 4.5–5 cm long, 1–1.5 cm wide. **Lip** 3-lobate, trumpet-shaped, 5.5–7 cm long, 2–4 cm wide in natural position; lateral lobes rounded, overlapping and embracing the column, midlobe broadly emarginate, recurved apically; callus sulcate along the midvein, with 2 hollowed areas laterally. **Column** subterete, 2–2.2 cm long, with fimbriate anther bed; pollinia 2, with viscidium and stipe.

Epiphytic, growing on larger branches in premontane rain forests at 1000–1200 m. Flowering May to July. Mexico to Costa Rica; perhaps also Panama.

This species is similar to *T. marginata* but has yellow flowers with ovary subtended by three broad bracts, and the sepals and petals are nearly flat.

Trichopilia maculata Rchb. f., Bonplandia. 3: 215. 1855. TYPE: Port Chagres (Panama?), *Kewferstein ex Behr* (type not found). Figure 49B.

Plant a caespitose epiphyte 15–20 cm tall. Rhizome short; roots ≤ 2 mm in diameter. **Pseudobulbs** elliptic-oblong, ancipitous, 5–7 cm long, 1–1.4 cm wide, the base enveloped in 3–4 spotted, imbricate bracts, apex 1-foliate. **Leaves** subcoriaceous, elliptic-lanceolate, 16–20 cm long, 3.5–4 cm wide, acute. **Inflorescence** usually solitary, slender, arcuate or somewhat pendent; scapes 4–6 cm long. **Flowers** of moderate size, white, lip pale yellow with orange-red centrally. **Sepals** subequal, free or connate near the base, broadly spreading, lanceolate, often somewhat twisted, 2.5–3 cm long, 3–5 mm wide. **Petals** similar to the sepals, lanceolate, 2.5–3 cm long, 3–5 mm wide, acuminate, with undulate margins. **Lip** shortly adnate to column base, obscurely 3-lobate, obovate when spread, 3.5–3.7 cm long, 1.6–2.2 cm wide, narrowed at the base; lateral margins rounded, convolute, forming a tube; midlobe emarginate, with spreading or reflexed lobules; callus with a short, inconspicuous, central keel. **Column** slender, semiterete; apical margins distinctly 3-parted and minutely denticulate; pollinia 2, with stipe and viscidium. Immature **capsule** 3 cm long.

Epiphytic in premontane rain forests at 100–400 m. Flowering May to July. Costa Rica and Panama; also doubtfully reported from Guatemala and El Salvador.

Trichopilia maculata is similar to *T. tortilis* but has yellow-green flowers with a yellow lip, and the sepals and petals are nearly flat. The pseudobulbs are invested with several heavily spotted bracts.

Trichopilia marginata Henfr., Gard. Mag. Bot. 3:185, t. 1851. TYPE: New Granada. *Trichopilia coccinea* Warsc., Paxton's Fl. Gard. 2:79. 1851. TYPE: Costa Rica, *Warscewicz* (w, photo

seen). *Trichopilia crispa* Lindl., Gard. Chron. 342. 1857. TYPE: Probably Costa Rica, based on Warscewicz collection, *Rücker* (κ, photo seen). Figure 50B.

Plant epiphytic, caespitose. Rhizome abbreviated; roots 1–2 mm in diameter. **Pseudobulbs** subcylindric, slightly tapering, laterally flattened, 1-foliate, 4–12 cm long, 1–3 cm wide, covered at the base when young by several bracts turning papery with age. **Leaves** coriaceous, elliptic-lanceolate, 10–25 cm long, 2.5–5.5 cm wide, conduplicate at the base, the apex acute and recurved. **Inflorescences** 1–3 borne laterally at the base of the pseudobulb, each consisting of a single flower borne on a short scape, pendulous; ovary and pedicel strongly curved, 2–3 cm long. **Flowers** 8–14 cm in diameter, variable in color; sepals and petals yellowish green with a band of reddish brown centrally; lip white spotted with wine red to entirely red with white margins. **Sepals** similar, twisted, linear lanceolate, 7.5–8 cm long, 1–1.3 cm wide, acute and lightly conduplicate at the apex; lateral sepals very shortly connate at the base. **Petals** similar to the sepals but somewhat broader, 6.5–7 cm long, 1.5–1.8 cm wide. **Lip** tubular, 3-lobate, 6–7 cm long, 3.5–4 cm wide when spread; lateral lobes clasping the column, separated from the midlobe by a shallow sinus; midlobe rounded and emarginate; callus poorly defined, an intense yellow furrow at the base. **Column** semiterete, clavate, greenish at the base, white at the apex, 2.5–3 cm long, provided apically with a prominent anther bed with lacerate margins; pollinia 2, waxy, with stipe and viscidium; stigma entire, cordate.

Epiphytic on the shady trunks of trees in premontane and lower montane rain forests at 1200–1500 m. Flowering December to July. Reported from Nicaragua to Colombia.

Trichopilia marginata is distinguished from similar *T. galeottiana* A. Rich & Gal. by the solitary white and wine red flowers with crisped sepals and petals.

Trichopilia suavis Lindl., Paxton's Fl. Gard. 1: 44. 1850–1851. TYPE: Central America, *Lodiges* (κ, photo seen). *Trichopilia kienastiana* Rchb. f., Gard. Chron. n.s. 20:166. 1881. TYPE: *Kienast* (w, photo seen). Figure 49C.

Plant epiphytic, shortly creeping to caespitose. Rhizome short; roots 1–2 mm in diameter. **Pseudobulbs** fleshy, ovoid to suborbicular, laterally flattened, 4–7.2 cm long, 3.5–6.2 cm wide, apically 1-foliate, protected at the base by several spotted bracts becoming papery with age. **Leaves** subcoriaceous, broadly elliptic, forming a conduplicate petiole at the base, the apex acute, 4.5–30 cm long, 3.8–8.2 cm wide. **Inflorescence** a lateral, short, arcuate or pendulous, 2–5-flowered raceme supported on a short peduncle; ovary and pedicel 3.5 cm long. **Flowers** with a fragrance similar to sweet peas, white with rose spots. **Sepals** similar, the laterals shortly connate, elliptic-lanceolate, the margins undulate, 3.3–

5.2 cm long, 8–10 mm wide, with a prominent keel abaxially on midvein. **Petals** similar to the sepals but broader, 3–5.2 cm long, 1–1.2 cm wide. **Lip** obscurely 3-lobate, tubular or horn-shaped in natural position, quadrate when expanded, adnate to the base of the column, 4.8–7 cm long, 3.5–4.8 cm wide, lateral lobes involute and clasping the column, apex retuse; margins undulate or crisped, disk of the lip with a prominent keel. **Column** elongate, terete, with a conspicuous lacerate anther bed at the apex; pollinia 2, waxy, with prominent stipe and viscidium.

Epiphytic on large branches and trunks in premontane rain forests at 550–1300 m along both Pacific and Atlantic slopes. Flowering February to April; rarely to May. Reported from Costa Rica to Colombia.

Trichopilia suavis has large, white, fragrant flowers with fragrance of sweet peas, and the lip is spotted with rose or purple. Occasionally white forms are seen. *Trichopilia suavis* is suspected of hybridizing with *T. marginata* Henfr. at its lowest elevations, where the two species are sympatric.

Trichopilia tortilis Lindl., Nat. Syst. Bot. (ed. 2) 446. 1836. Edwards's Bot. Reg. 22: t. 1863. 1836. TYPE: Mexico, *Barker* (κ, photo seen). Figure 50A.

Plant epiphytic, caespitose. Rhizome abbreviate; roots 2–3 mm in diameter. **Pseudobulbs** oblong to cylindric, compressed, 5.5–7 cm long, 1.5–2 cm wide, the base concealed by one or more bracts spotted with brown, apically 1-foliate. **Leaves** subcoriaceous, elliptic-lanceolate, abaxially carinate, forming a conduplicate petiole at the base, apically acute, 8–15 cm long, 3.5–4 cm wide. **Inflorescence** a short scape with a single flower borne laterally at the base of the pseudobulb; ovary and pedicel curved, 3 cm long. **Flowers** 10–13 cm across; sepals and petals greenish white with a brown longitudinal band centrally for its entire length; lip white with brown spots. **Sepals** and **petals** similar, linear-lanceolate, acute to acuminate, strongly twisted and with undulate margins, 5.5–7.5 cm long, 8–12 mm wide. **Lip** adnate to the base of the column, obscurely 3-lobate, the side lobes involute and clasping the column forming a tube at the base, 5.5–6.2 cm long, 4–5.2 cm wide when spread, elliptic-suborbicular, emarginate; disk with a pair of excavated areas near the column apex. **Column** white, semiterete with fimbriate, tripartite anther bed; pollinia 2, with prominent stipe and viscidium.

Reportedly uncommon epiphyte of premontane rain forests of the Atlantic slope at 1000–1200 m, where it has been collected in Zapotal de Perez Zeledón. The Costa Rican forms are somewhat larger than those from farther north. Flowering April to June. Reported from Costa Rica but seen only in live collections.

Trichopilia tortilis differs from *T. maculata* by the strongly twisted sepals and petals, larger pseudobulbs, and the brown-spotted lip.

Trichopilia turialbae Rchb. f., *Hamburger Garten-Blumenzeitung* 19:11–12. 1863. TYPE: Costa Rica, *Wendland* (w, photo seen). Figure 49D.

Plant a caespitose epiphyte. Rhizome short; roots about 2 mm in diameter. **Pseudobulbs** ovoid-lanceolate, compressed, 6–9 cm long, 2.5–3.5 cm wide, 1-foliate. **Leaves** coriaceous, elliptic, acute, with prominent keel abaxially, 18–25 cm long, 4–6 cm wide, short-petiolate, acute. **Inflorescence** a short, lateral, 2–5-flowered, raceme 8–11 cm long; ovary with pedicel 4–4.5 cm long, subtended by a triangular floral bract about 3 cm long. **Flowers** not spreading widely, membranaceous, short-lived, 4.4–5 cm long, 1.5–1.8 cm wide in natural position. **Sepals** similar, elliptic-lanceolate, acuminate, 4 cm long, 4–5 mm wide; dorsal free, recurved; laterals ca. $\frac{2}{3}$ connate, the apices somewhat recurved. **Petals** similar to the dorsal sepal but somewhat broader and with undulate margins, 4–4.5 cm long, 7–9 mm wide. **Lip** adnate to the base of the column, 3-lobate, trumpet shaped with upcurved, tubular base, 4–5 cm long, 3–4 cm wide when spread; midlobe emarginate and reflexed; lateral lobes inrolled around the column; callus of 3 elevated keels centrally. **Column** subterete, 1.5 cm long, with 3 fimbriate projections apically; pollinia 2, waxy, pyriform, compressed, with prominent viscidium and stipe.

Epiphytic in premontane rain forests at 600–1200 m. Flowering October to January. Nicaragua to Panama; also reported from Colombia.

Trichopilia turialbae is easily distinguished in Costa Rica by the rather small creamy white flowers, borne 2–5 per inflorescence. Also, the tepals are nonspreading. It has been confused by authors with *T. galeottiana* A. Rich. & Gal., but that species has larger flowers with essentially flat, spreading, much broader sepals and petals.

Trizeuxis Lindl.

(D. E. Mora de Retana)

Plant a psygmoid epiphyte. Stems short, pseudobulbs small, suborbicular, compressed, concealed by several leaves arranged in a fan, apically 1-foliate. **Leaves** articulate, fleshy, conduplicate, equitant, falcate. **Inflorescence** lateral, paniculate, each branch apex densely flowered. **Flowers** very small, subglobose. **Sepals** dissimilar, concave, shortly united at the base, lateral sepals connate to near the bifid apex. **Petals** elliptic-ovate, concave at the base, obtuse to bluntly acute. **Lip** simple or obscurely 3-lobate, apex fleshy and recurved, margins erect and parallel with the column. **Column** stout, widened at the

apex, with neither foot nor wings; anther terminal; pollinia 2, waxy, with simple elongate stipe and viscidium. **Fruit** a capsule.

A Neotropical genus of a single widespread species ranging from Costa Rica to Bolivia, Brazil, and the West Indies.

On the basis of the flowers, *Trizeuxis* seems related to *Ionopsis*, a relationship supported by the molecular data of Chase and Palmer.

Trizeuxis falcata Lindl., *Coll. Bot.* t. 2. 1823 (neither description nor type seen). Figure 50D.

Plant epiphytic often on twigs, forming small clumps, to ca. 8 cm tall. Rhizome short; roots large for the plant, to 1 mm in diameter. **Pseudobulbs** small, suborbicular, compressed, 1–1.2 cm long and high, the base covered by 2–4 leaves, apically 1-foliate. **Leaves** articulate, fleshy, conduplicate, falcate, 5–12 cm long, 5–8 mm wide (deep), acute. **Inflorescence** lateral, paniculate, exceeding the leaves; ovary with pedicel 1.2 mm long. **Flowers** minute, subglobose, yellow-green with orange lip. **Sepals** dissimilar, shortly united at the base; dorsal concave, elliptic-ovate, 3–3.2 mm long, 2–2.3 mm wide, obtuse; lateral sepals connate to near the bifid apex, 3–3.2 mm long, 1–1.1 mm wide. **Petals** similar to the dorsal sepal, concave at the base, elliptic-ovate, obtuse or subacute. **Lip** simple or obscurely 3-lobate, 4–4.2 mm long, 2–2.2 mm wide, lateral margins erect and parallel with the column, apex fleshy and recurved; callus sulcate, consisting of a pair of fleshy lateral projections to beyond the middle. **Column** stout, broadened apically, to 2 mm long; anther terminal; pollinia with well-developed stipe and viscidium.

Uncommon epiphyte of twigs and smaller branches, usually of disturbed evergreen forests at 50–900 m. Often seen growing on citrus, hibiscus, and coffee. Flowering February to April. Widespread from Costa Rica to Bolivia, Brazil, and the West Indies.

Trizeuxis falcata is easily recognized by the densely clustered, tiny, bell-shaped flowers and the plant with equitant leaves.

Warmingia Rchb. f.

(J. T. Atwood, based on reference below)

REFERENCE—B. Johansen, *Warmingia margaritacea* sp. nov. (Orchidaceae) from Costa Rica and a review of the genus. *Lindleyana* 7:194–198. 1992.

Plant a caespitose epiphyte. **Pseudobulbs** present, subtended by nonfoliaceous bracts; apex 1-foliate. **Inflores-**

cence a lateral few-flowered raceme. **Flowers** white or white with yellow. **Sepals** subequal. **Petals** usually rhombic and dentate, broader than the sepals. **Lip** 3-lobate, the lateral lobes usually rounded and dentate, the midlobe elongate. **Column** elongate, anther lacking a conspicuous anther bed; pollinia 2, with short or elongate stipe and viscidium. **Fruit** a capsule.

A Neotropical genus of about four species with scattered distribution in Bolivia, Brazil, Costa Rica, and Ecuador.

Warmingia is closely related to *Macradenia*, a genus with green to red flowers and usually a flared, variously dentate anther bed. The DNA work of Chase and Palmer show a close relationship of these genera with *Notylia* and *Macroclonium*.

Warmingia margaritacea B. Johans., Lindleyana 7:194–196. 1992. TYPE: Costa Rica, Turrialba, C.A.T.I.E., 600 m, Johansen & Sørensen 138 (holotype: c, not seen).

Plant an epiphytic herb to 7 cm high. Roots white, smooth, 1 mm in diameter. **Pseudobulbs** small, of a single internode, conic to ovoid, 7–8 mm tall, 3–4 mm wide, covered with 3–4 withering brown sheaths. **Leaves** dark green, coriaceous, lanceolate, somewhat falcate, 3.5–6 cm long including the 0.6–1.0-cm-long petiole, 1–1.7 cm wide. **Inflorescence** a lateral, pendulous raceme, to 3 cm long, with 2–3(4) flowers; bracts triangular, 6 mm long, 3 mm wide at the base; ovary with pedicel 8–9 mm long. **Flowers** ivory white and semiopaque; apparently autogamous. **Sepals** similar; dorsal slightly concave, elliptic-lanceolate, 8 mm long, 3 mm wide with a carinate, acute apex; lateral sepals slightly falcate, 7 mm long, 3 mm wide. **Petals** rhombic, 8 mm long, 5 mm wide, apex slightly carinate, margins denticulate-erose to somewhat crispate. **Lip** 3-lobate just above the base, 8 mm long, 9 mm wide across the lateral lobes when spread, with erose-serrate margins; lateral lobes erect, transversely elliptic to reniform, 3 mm long, 5 mm wide; midlobe broadly ovate, 8 mm long, 3 mm wide; callus 2-lobate, deeply sulcate, appearing to originate from the base of the sidelobes. **Column** terete to semiterete, 3 mm long, 1 mm wide, slightly expanded and with 2 appendages at the apex; anther ovate with a decurved truncate apex; pollinia with short stipe and viscidium. **Capsule** ellipsoid to obovoid, 12 mm long, 8 mm wide.

The above description is quoted and paraphrased directly from the original description because the species is known only from the holotype. *Warmingia margaritacea* was originally found growing on a cultivated hibiscus hedge at Turrialba (600 m) and must have originated from elsewhere, where it is hopefully more common. Endemic to Costa Rica, where it is reported to be autogamous.

Warmingia margaritacea should be easily recognized by the small plants and white flowers with dentate petals and lip. They may have been overlooked because of their small size or, alternatively, may be extremely rare.

Addendum to Subtribe Maxillariinae

One new species of *Maxillaria*, published by I. Bock in *Die Orchidee*, appeared as this work was in press. In addition, one other new species, authored by J. T. Atwood, is currently in press in *Selbyana*.

The first species, *Maxillaria admonens* I. Bock (*Orchidee* 48:105–107. 1997), should be compared to *M. gomeziana* J. T. Atwood (p. 59). Bock claims that *M. admonens* differs in the broader egg-shaped pseudobulbs, the more compact plant, and by the lip forming a sharper angle with the column foot. At this time we cannot confirm or reject this as a new species but note that the diagnostic drawings resemble *M. gomeziana*, remembering that plant habits are generally variable in *Maxillaria*. Flower color patterns of *M. admonens* evident in the separations are very similar to those of flowers from which the holotype of *M. gomeziana* was prepared. The illustration provided by Bock shows the same central keel in the callus that is consistent with both *M. bracteata* and *M. gomeziana*; therefore *M. admonens* cannot be excluded from those taxa on this character alone.

On page 72 a reference is made comparing specimen *Mora 60* (INB) to *M. mombachoensis* Heller ex J. T. Atwood. The specimen differs from that species in the shorter peduncles, shorter ovaries, and the shorter and remarkably thick leaves. This species, apparently a narrow Costa Rican endemic, was published shortly after the present work had gone to press. The description of it is paraphrased below.

Maxillaria cacaoensis J. T. Atwood, *Selbyana* 19: 254–255. 1999. TYPE: Costa Rica. Province of Guanacaste: Cantón of Liberia, Cordillera de Guanacaste, Cerro Cacao, Estación Cacao, 1100 m, A. *Mora 60* (holotype: INB: isotype: SEL). Figure 51.

Plant caespitose, apparently densely so, to about 10 cm tall; roots to ca. 2 mm in diameter. **Pseudobulbs** coarsely rugose in dried specimens, semiobicular, com-

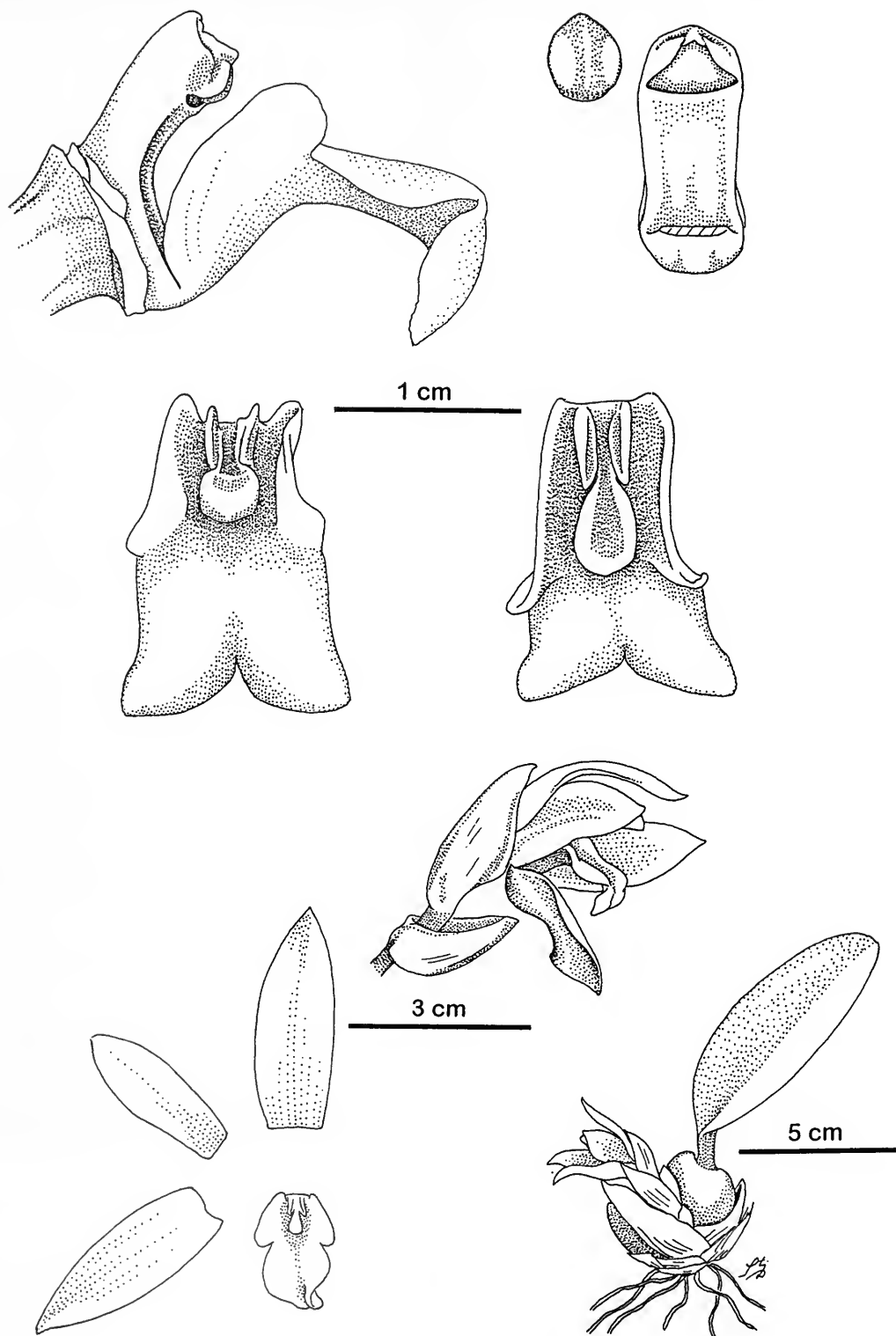


FIG. 51. *Maxillaria cacaoensis*.

pressed, 2–3.5 cm long, 2.5 cm wide, subtended by sheaths that are apparently bladeless; apex 1-foliate. **Leaves** coriaceous, strongly keeled beneath especially apically; blades 6–9 cm long, 2–3 cm wide in the type, obtuse. **Inflorescences** short; scapes ca. 3 cm long, concealed by inflated bracts; ovary about 1.5 cm long, concealed by the subtending floral bract. **Flowers** campanulate to somewhat spreading, yellowish orange with white at the base of the sepals and petals; lips reddish. **Sepals** ovate-lanceolate, 3.5 cm long, 1.5 cm wide, acute. **Petals** elliptic-ob lanceolate, acute, 2.8 cm, 1 cm wide. **Lip** hinged to the column foot, sharply 3-lobate at about $\frac{2}{5}$ from the base; lateral lobes rounded in front, somewhat clasping the column; midlobe fleshy, ovate, recurved to somewhat reflexed, ca. 1.8 cm long, 1.4 cm wide in natural position, bluntly acute to obtuse; calli 2, of 2 keels in front ending just below the base of the midlobe. **Column** stout, nearly straight, ca 1.4 cm long, including anther; foot 5–6 mm long; anther ca. 4 mm.

Known only by the type collection from a cloud forest on Cerro Cacao in northern Costa Rica at 1100 m. Flowering at least in January and February, according to the collection date.

Maxillaria cacaoensis is most similar to Nicaraguan *M. mombachoensis* J. T. Atwood in flower color and in the large floral bracts, but has a much shorter ovary and noticeably shorter and thicker leaves. There may be yet another closely related undescribed species on Volcán Maderas in Lake Nicaragua with smaller flowers. Apparently, isolation on these mountaintops enables the separate populations to develop identifiably distinct traits. Pollinators in this group are unknown, but the large, inflated floral bracts and fleshy orange to yellow flowers suggest pollination by hummingbirds.

Maxillaria cacaoensis is a member of the difficult *M. cucullata* Lindl. complex, represented in Costa Rica by four species and in Panama by one. The following key, modified from page 39, should distinguish them in this area.

- 32a. Flowers with trigonous ovaries, sepals and petals greenish stained with purple *M. obscura*
- 32b. Flowers otherwise X
 - Xa. Flowers basically cream, lip spotted with maroon *M. cedralensis*
 - Xb. Flowers otherwise Y
 - Ya. Floral bract $> 1.5 \times$ ovary; flowers unspotted . . . *M. cacaoensis*
 - Yb. Floral bract $< 1.25 \times$ ovary, flowers greenish or orangish, with small spots arranged in lines *M. punctostriata*

Addendum to Subtribe Oncidiinae: Leucohyle Klotzsch

(Joaquín B. García-Castro and D. E. Mora de Retana)

Plants generally epiphytic, caespitose and compact; rhizome short. **Pseudobulbs** small, especially in the Costa Rican species, cylindric or conic, truncate, with a single fleshy, linear or subterete and sulcate leaf. **Inflorescence** lateral at the pseudobulb base, pendent. **Flowers** small, attractive, with whitish or translucent ground color. **Sepals** and **petals** similar, slender and undulate, the lateral sepals free. **Lip** united to the base of the column, prominently concave and with irregular border. **Column** short, semiterete, apically with a hood with irregularly dentate margin; pollinarium with two pyriform pollinia, supported on a slender linear-lanceolate stipe and small viscidium.

A genus of only two accepted species distributed from Mexico to Brazil and the Antilles; one species in Costa Rica. Recent work of Norris Williams and Mark Whitten (unpublished) suggests a close relationship with *Trichopilia* Lindl., *Helcia* Lindl., and *Neoscobaria* Garay.

Leucohyle subulata (Sw.) Schltr., Die Orchideen 469. 1914. *Epidendrum subulatum* Sw., Prodr. Ind. Occ. 123. 1788. TYPE: West Indies (not seen). *Cymbidium subulatum* (Sw.) Sw., Nov. Act. Soc. Ups. 6:73. 1799. *Trichopilia subulata* (Sw.) Rehb. f. Flora 48:278. 1865.

Plant epiphytic, caespitose; rhizome short; roots 1–2 mm in diameter. **Pseudobulbs** fleshy, subconic to cylindric, 0.8–3 cm long, 2–5 mm broad, concealed at the base when young by several dark fibrous bracts; apex 1-foliate. **Leaves** fleshy, linear-lanceolate to semiterete, sulcate above, conduplicate at the base, apex acuminate, 8–25 cm long, 3–10 mm wide. **Inflorescence** pendent, a raceme of 3–8 flowers supported on a slender peduncle; ovary and pedicel slender, about 1.4 cm long; floral bracts papery, obovate-elliptic, acuminate, 9 mm long, 5 mm wide. **Flowers** small, translucent white with the lip spotted with red, especially near the base. **Sepals** subequal, linear-lanceolate, the apex mucronate, with undulate margin, 1.6–2.6 cm long, 2–4 mm wide. **Petals** similar to the sepals but somewhat shorter and broader, somewhat twisted, 1.5–2 cm long, 3–6 mm wide. **Lip** basally adnate to the column, simple, concave, rounded to subcordate, with irregularly denticulate margins, 1.5–2 cm long, 1.2–1.8 cm wide, apex apiculate; disc with a basal depressed, subquadrate callus continued in front by two lateral low keels and a somewhat more prominent central keel. **Column** semiterete, somewhat recurved; apex with a hood covering the anther, with irregular border.

This species is reported from Mexico and Nicaragua to Peru and Venezuela and the West Indies. It is known in Costa Rica from San Carlos, Province of Alajuela, and from Turrialba, Province of Cartago. It appears similar to a small trichopilia but has subconic-cylindric pseudobulbs in addition to more slender and more fleshy subterete leaves. The flowers are somewhat unusual for the unlobed concave lip and the column apex appearing apically hooded.

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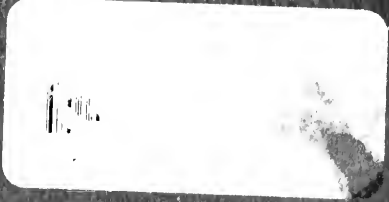
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Families of seed plants known or expected to occur in Costa Rica and adjacent areas numbered according to the sequence of Engler's *Syllabus der Pflanzenfamilien*, edition 11, reworked by L. Diels (1936).

1	Cycadaceae	70	Caryophyllaceae	138	Caryocaraceae
2	Taxaceae	71	Nymphaeaceae	139	Marcgraviaceae
3	Podocarpaceae	72	Ceratophyllaceae	140	Quinaceae
4	Araucariaceae	73	Ranunculaceae	141	Theaceae
5	Pinaceae	74	Berberidaceae	142	Guttiferae
6	Cupressaceae	75	Menispermaceae		incl. Hypericaceae
7	Gnetaceae	76	Magnoliaceae	143	Elatinaceae
8	Typhaceae	77	Annonaceae	144	Cistaceae
9	Potamogetonaceae	78	Myristicaceae	145	Bixaceae
10	Najadaceae	79	Monimiaceae	146	Cochlospermaceae
11	Alismataceae	80	Lauraceae	147	Violaceae
12	Butomaceae	81	Hernandiaceae	148	Flacourtiaceae
13	Hydrocharitaceae	82	Papaveraceae	149	Turneraceae
14	Triuridaceae		incl. Fumariaceae	150	Passifloraceae
15	Gramineae	83	Capparidaceae	151	Caricaceae
16	Cyperaceae	84	Cruciferae	152	Loasaceae
17	Palmaceae	85	Tovariaceae	153	Begoniaceae
18	Cyclanthaceae	86	Resedaceae	154	Cactaceae
19	Araceae	87	Moringaceae	155	Thymelaeaceae
20	Lemnaceae	88	Droseraceae	156	Elaeagnaceae
21	Mayacaceae	89	Crassulaceae	157	Lythraceae
22	Xyridaceae	90	Saxifragaceae	158	Punicaceae
23	Eriocaulaceae	91	Brunelliaceae	159	Lecythidaceae
24	Bromeliaceae	92	Cunoniaceae	160	Rhizophoraceae
25	Commelinaceae	93	Hamamelidaceae	161	Combretaceae
26	Pontederiaceae	94	Rosaceae	162	Myrtaceae
27	Juncaceae	95	Connaraceae	163	Melastomataceae
28	Liliaceae	96	Leguminosae	164	Onagraceae
29	Haemodoraceae	97	Krameriaceae	165	Haloragaceae
30	Amaryllidaceae	98	Oxalidaceae	166	Araliaceae
31	Velloziaceae	99	Geraniaceae	167	Umbelliferae
32	Dioscoreaceae	100	Tropaeolaceae	168	Cornaceae
33	Iridaceae	101	Linaceae	169	Clethraceae
34	Musaceae		incl. Humiriaceae	170	Monotropaceae
35	Zingiberaceae	102	Erythroxylaceae	171	Pyrolaceae
36	Cannaceae	103	Zygophyllaceae	172	Ericaceae
37	Marantaceae	104	Rutaceae	173	Theophrastaceae
38	Burmanniaceae	105	Simarubaceae	174	Myrsinaceae
39	Orchidaceae	106	Burseraceae	175	Primulaceae
40	Casuarinaceae	107	Meliaceae	176	Plumbaginaceae
41	Piperaceae	108	Malpighiaceae	177	Sapotaceae
42	Chloranthaceae	109	Trigoniaceae	178	Ebenaceae
43	Laciniaceae	110	Vochysiaceae	179	Symplocaceae
44	Salicaceae	111	Polygalaceae	180	Styracaceae
45	Garryaceae	112	Dichapetalaceae	181	Oleaceae
46	Myricaceae	113	Euphorbiaceae	182	Loganiaceae
47	Juglandaceae	114	Callitrichaceae	183	Gentianaceae
48	Batidaceae	115	Buxaceae	184	Apocynaceae
49	Betulaceae	116	Coriariaceae	185	Asclepiadaceae
50	Fagaceae	117	Anacardiaceae	186	Convolvulaceae
51	Ulmaceae	118	Cyrillaceae	187	Polemoniaceae
52	Moraceae	119	Aquifoliaceae	188	Hydrophyllaceae
53	Urticaceae	120	Celastraceae	189	Boraginaceae
54	Podostemonaceae	121	Hippocrateaceae	190	Verbenaceae
55	Proteaceae	122	Staphyleaceae	191	Labiatae
56	Olcaceae	123	Icacuinaceae	192	Solanaceae
57	Opiliaceae	124	Hippocastanaceae	193	Scrophulariaceae
58	Loranthaceae	125	Sapindaceae	194	Bignoniaceae
59	Aristolochiaceae	126	Sabiaceae	195	Pedaliaceae
60a	Hydnoraceae	127	Balsaminaceae	196	Martyniaceae
60b	Rafflesiaceae	128	Rhamnaceae	197	Orobanchaceae
61	Balanophoraceae	129	Vitaceae	198	Gesneriaceae
62	Polygonaceae	130	Elaeocarpaceae	199	Lentibulariaceae
63	Chenopodiaceae	131	Tiliaceae	200	Acanthaceae
64	Amaranthaceae	132	Malvaceae	201	Plantaginaceae
65	Nyctaginaceae	133	Bombacaceae	202	Rubiaceae
66	Phytolaccaceae	134	Sterculiaceae	203	Caprifoliaceae
67	Aizoaceae	135	Dilleniaceae	204	Valerianaceae
68	Portulacaceae	136	Actinidiaceae	205	Dipsacaceae
69	Basellaceae	137	Ochnaceae	206	Cucurbitaceae
				207	Campanulaceae
				208	Compositae



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